OPTICAL DEVICE, METHOD FOR MANUFACTURING THE SAME AND LIQUID CRYSTAL DEVICE

Publication number: JP2002062422
Publication date: 2002-02-28
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Applicant: CANON KK
Classification:
- international: ***G02B5/20; G02F1/1335; H01L51/50; H05B33/10; H05B33/12; H05B33/22;*** *H01L27/32;* **G02B5/20; G02F1/13; H01L51/50; H05B33/10; H05B33/12; H05B33/22;** H01L27/28; (IPC1-7): G02B5/20; G02F1/1335; H05B33/10; H05B33/12; H05B33/14; H05B33/22
- European:
Application number: JP20000245576 20000814
Priority number(s): JP20000245576 20000814

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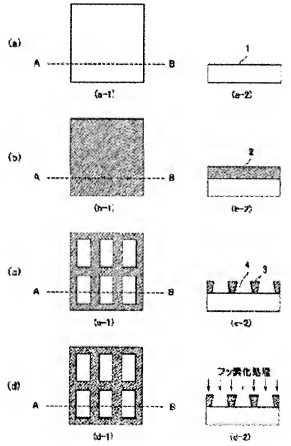
Abstract of **JP2002062422**

PROBLEM TO BE SOLVED: To prevent mixing of colors and void in the method for manufacturing an optical device to form pixels by an ink jet method. SOLUTION: Barrier walls 3 having an inversed tapered cross section are formed on a supporting substrate 1 and fluorinated to enhance the ink repelling property of the upper face of the barrier walls 3. Then ink is supplied to the openings 4 to form pixels.



(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（A）**　(11)特許出願公開番号
特開2002－62422
（P2002－62422A）
(43)公開日　平成14年２月28日(2002.2.28)

(51)Int.Cl.⁷		識別記号	FI			テーマコード（参考）
G02B	5/20	101	G02B	5/20	101	2H048
G02F	1/1335	505	G02F	1/1335	505	2H091
H05B	33/10		H05B	33/10		3K007
	33/12			33/12	B	
	33/14			33/14	A	

審査請求　未請求　請求項の数16　ＯＬ　（全 14 頁）　最終頁に続く

(21)出願番号　特願2000－245576(P2000－245576)
(22)出願日　平成12年８月14日(2000.8.14)

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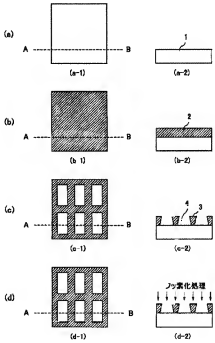
(54)【発明の名称】　光学素子とその製造方法、液晶素子

(57)【要約】
【課題】　インクジェット方式により画素を形成する光学素子の製造方法において、混色、白抜けを防止する。
【解決手段】　支持基板１上に、断面が逆テーパー形状の隔壁３を形成し、フッ素化処理を施すことによって、該隔壁３の上面の撥インク性を高めた後、開口部４にインクを付与して画素を形成する。



【特許請求の範囲】

【請求項１】　支持基板上に複数の画素と隣接する画素間に位置する樹脂組成物からなる隔壁とを少なくとも有する光学素子の製造方法であって、支持基板上に、該基板の法線方向の断面が逆テーパー形状の隔壁を形成する工程と、上記隔壁表面にフッ素化処理を施す工程と、インクジェット方式により上記隔壁で囲まれた領域にインクを付与して画素を形成する工程と、を有することを特徴とする光学素子の製造方法。

【請求項２】　上記フッ素化処理が、少なくともフッ素原子を含有するガスを導入してプラズマ照射を行うプラズマ処理である請求項１に記載の光学素子の製造方法。

【請求項３】　上記隔壁を、遮光剤を含有する樹脂組成物で形成する請求項１または２に記載の光学素子の製造方法。

【請求項４】　上記遮光剤がカーボンブラックである請求項３に記載の光学素子の製造方法。

【請求項５】　上記フッ素化処理に先立って、隔壁表面及び支持基板表面に親インク化処理を施す請求項１～４のいずれかに記載の光学素子の製造方法。

【請求項６】　上記親インク化処理が、アルカリ水溶液による洗浄処理、ＵＶ洗浄処理、エキシマ洗浄処理、コロナ放電処理、酸素プラズマ処理のいずれかである請求項５に記載の光学素子の製造方法。

【請求項７】　上記インクが少なくとも硬化成分、水、有機溶剤を含有する請求項１～６のいずれかに記載の光学素子の製造方法。

【請求項８】　上記インクが着色剤を含有し、画素が着色部であるカラーフィルタを製造する請求項１～７のいずれかに記載の光学素子の製造方法。

【請求項９】　上記画素が発光層であるエレクトロルミネッセンス素子を製造する請求項１～７のいずれかに記載の光学素子の製造方法。

【請求項１０】　支持基板上に複数の画素と隣接する画素間に位置する隔壁とを少なくとも有し、請求項１～７のいずれかに記載の光学素子の製造方法により製造されたことを特徴とする光学素子。

【請求項１１】　上記隔壁が遮光層である請求項１０に記載の光学素子。

【請求項１２】　上記支持基板が透明基板であり、上記画素が着色剤を含有するインクで形成された着色部であり、複数色の着色部を備えたカラーフィルタである請求項１０または１１に記載の光学素子。

【請求項１３】　上記着色部上に保護層を有する請求項１２に記載の光学素子。

【請求項１４】　表面に透明導電膜を有する請求項１２または１３に記載の光学素子。

【請求項１５】　上記画素が発光層であり、該発光層を挟んで上下に電極を有するエレクトロルミネッセンス素子である請求項１０または１１に記載の光学素子。

【請求項１６】　一対の基板間に液晶を挟持してなり、一方の基板が請求項１２～１４のいずれかに記載の光学素子を用いて構成されたことを特徴とする液晶素子。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、カラーテレビ、パーソナルコンピュータ、パチンコ遊技台等に使用されているカラー液晶素子の構成部材であるカラーフィルタ、及び、複数の発光層を備えたエレクトロルミネッセンス素子といった光学素子を、インクジェット方式を利用して製造する製造方法に関し、さらには、該製造方法により製造される光学素子、及び該光学素子の一つであるカラーフィルタを用いてなる液晶素子に関する。

【０００２】

【従来の技術】近年、パーソナルコンピュータの発達、特に携帯用パーソナルコンピュータの発達に伴い、液晶ディスプレイ、特にカラー液晶ディスプレイの需要が増加する傾向にある。しかしながら、さらなる普及のためにはコストダウンが必要であり、特にコスト的に比重の重いカラーフィルタのコストダウンに対する要求が高まっている。

【０００３】従来から、カラーフィルタの要求特性を満足しつつ上記の要求に応えるべく、種々の方法が試みられているが、未だ全ての要求特性を満足する方法は確立されていない。以下にそれぞれの方法を説明する。

【０００４】第一の方法は染色法である。染色法は、先ず透明基板上に染色用の材料である、水溶性の高分子材料層を形成し、これをフォトリソグラフィ工程により所望の形状にパターニングした後、得られたパターンを染色浴に浸漬して着色されたパターンを得る。この工程を３回繰り返すことにより、Ｒ（赤）、Ｇ（緑）、Ｂ（青）の３色の着色部からなる着色層を形成する。

【０００５】第二の方法は顔料分散法であり、近年最も盛んに行われている。この方法は、先ず透明基板上に顔料を分散した感光性樹脂層を形成し、これをパターニングすることにより、単色のパターンを得る。この工程を３回繰り返すことにより、Ｒ、Ｇ、Ｂの３色の着色部からなる着色層を形成する。

【０００６】第三の方法としては電着法がある。この方法は、先ず透明基板上に透明電極をパターニングし、顔料、樹脂、電解液等の入った電着塗装液に浸漬して第一の色を電着する。この工程を３回繰り返して、Ｒ、Ｇ、Ｂの３色の着色部からなる着色層を形成し、最後に焼成するものである。

【０００７】第四の方法としては、熱硬化型の樹脂に顔料を分散し、印刷を３回繰り返すことにより、Ｒ、Ｇ、Ｂを塗り分けた後、樹脂を熱硬化させることにより、着色層を形成するものである。いずれの方法においても、着色層の上に保護層を形成するのが一般的である。

【０００８】これらの方法に共通している点は、Ｒ、

Ｇ、Ｂの３色を着色するために同一の工程を３回繰り返す必要があり、コスト高になることである。また、工程数が多い程、歩留まりが低下するという問題も有している。さらに、電着法においては、形成可能なパターン形状が限定されるため、現状の技術ではＴＦＴ型（ＴＦＴ、即ち薄膜トランジスタをスイッチング素子として用いたアクティブマトリクス駆動方式）の液晶素子の構成には適用困難である。

【０００９】また、印刷法は解像性が悪いため、ファインピッチのパターン形成には不向きである。

【００１０】上記のような欠点を補うべく、近年、インクジェット方式を利用したカラーフィルタの製造方法が盛んに検討されている。インクジェット方式を利用した方法は、製造プロセスが簡略で、低コストであるという利点がある。

【００１１】一方、インクジェット方式はカラーフィルタの製造に限らず、エレクトロルミネッセンス素子の製造にも応用が可能である。

【００１２】エレクトロルミネッセンス素子は、蛍光性の無機及び有機化合物を含む薄膜を、陰極と陽極とで挟んだ構成を有し、上記薄膜に電子及び正孔（ホール）を注入して再結合させることにより励起子を生成させ、この励起子が失活する際の蛍光の放出を利用して発光させる素子である。このようなエレクトロルミネッセンス素子に用いられる蛍光性材料を、例えばＴＦＴ等素子を作り込んだ基板上にインクジェット方式により付与して発光層を形成し、素子を構成することができる。

【００１３】

【発明が解決しようとする課題】上記したように、インクジェット方式は製造プロセスの簡略化及びコスト削減を図ることができることから、カラーフィルタやエレクトロルミネッセンス素子といった光学素子の製造へ応用されている。しかしながら、このような光学素子の製造において、インクジェット方式特有の問題として、「混色」及び「白抜け」と言った問題がある。以下、カラーフィルタを製造する場合を例に挙げて説明する。

【００１４】「混色」は、隣接する異なる色の画素（着色部）間においてインクが混ざり合うことにより発生する障害である。ブラックマトリクスの開口部にインクを付与して着色部を形成するカラーフィルタの製造方法においては、ブラックマトリクスの開口部の容積に対して、数倍～数十倍の体積を有するインクを付与する必要がある。インク中に含まれる着色剤や硬化成分等の固形分濃度が高い場合、即ち付与するインクの体積が比較的少ない場合においては、ブラックマトリクスが十分に隔壁として機能し、該ブラックマトリクスの開口部内にインクを保持することができるため、付与されたインクがブラックマトリクスを乗り越えて、隣接する異なる色の着色部にまで到達することはない。しかしながら、インク中の固形分濃度が低い場合、即ち多量のインクを付与する必要がある場合には、隔壁となるブラックマトリクスを超えてインクがあふれてしまうため、隣接する着色部間で混色が発生してしまう。特に、インクジェットヘッドのノズルより安定して吐出可能なインクの粘度には限界があり、インク中に含有される固形分の濃度にも限界があるため、混色を回避するための技術が必要である。

【００１５】そこで、着色部と隔壁との間におけるインクの濡れ性の差を利用して混色を防止する方法が提案されている。例えば、特開昭５９－７５２０５号においては、インクが目的領域外へ広がることを防止するため、濡れ性の悪い物質で拡散防止パターンを形成する方法が提案されているが、具体的な技術は開示されていない。一方、特開平４－１２３００５号においては、具体的な手法として、撥水、撥油作用の大きなシリコーンゴム層をパターニングして混色防止用の仕切壁とする方法が提案されている。さらに、特開平５－２４１０１２号公報においても同様に、遮光層となるブラックマトリクス上にシリコーンゴム層を形成し、混色防止用の隔壁として用いる手法が開示されている。

【００１６】これらの方法によれば、隔壁の高さをはるかに超える量のインクを付与した場合においても、隔壁の表面層が撥インク性を示すためにインクがはじかれ、隔壁を超えて隣接する着色部にまで及ぶことがなく、有効に混色を防止することができる。

【００１７】図３にその概念図を示す。図中、３１は透明基板、３３は隔壁を兼ねたブラックマトリクス、３６はインクである。ブラックマトリクス３３の上面が撥インク性を有する場合には、図３（ｂ）に示すように、付与されたインク３６がブラックマトリクス３３の開口部中に保持され、隣接する着色部にまで達することはない。しかしながら、ブラックマトリクス３３の上面の撥インク性が低い場合には、図３（ａ）に示すように、付与されたインク３６がブラックマトリクス３３上にまで濡れ広がり、隣接する開口部に付与されたインクと混じり合ってしまう。

【００１８】また、一般的にはシリコン化合物を用いるよりも、フッ素化合物を用いる方がより優れた撥インク性を得ることができる。例えば、特開２０００－３５５１１号において、遮光部上にポジ型のレジストパターンを形成し、さらに該パターン上に撥インク化処理剤を塗布する方法が開示されており、撥インク化処理剤としては、フッ素化合物を用いることが開示されている。しかしながら、この方法の場合、遮光部上に設けられたポジ型レジストパターンを着色部形成後に除去する必要があるが、レジストパターンを除去する際に画素の溶解、剥離、膨潤といった問題を生じる場合がある。

【００１９】また、樹脂層の表面をフッ素化する手法としては、特開平６－６５４０８号にフッ素化合物の反応ガスをプラズマ化して処理する方法が提案されている。

さらに、この技術をカラーフィルタに適用した例としては、特開平11－271753号において、隔壁をインクに対して親和性を有する下層と、非親和性を有する上層の多層構造とし、上層をインクに対して非親和性とする手法として、フッ素化合物を含むガスによりプラズマ処理する方法が開示されている。

【0020】しかしながら、上述した手法はいずれも隔壁を多層化するものであり、フォトリソグラフィ工程を複数回実施する必要があることから、プロセスの複雑化、コストアップ、ひいては歩留まり低下を招くという問題がある。

【0021】一方、「白抜け」は、主に付与されたインクが隔壁によって囲まれた領域内に十分且つ均一に拡散することができないことに起因して発生する障害であり、色ムラやコントラストの低下といった表示不良の原因となる。

【0022】図4に、白抜けの概念図を示す。図中、図3と同じ部材には同じ符号を付した。また、38は白抜け部分である。

【0023】近年、TFT型液晶素子用のカラーフィルタにおいては、TFTを外光から保護する目的で、或いは、開口率を大きくして明るい表示を得る目的で、ブラックマトリクス33の開口部形状が複雑になっており、複数のコーナー部を有するものが一般的に使用されているため、図4（a）に示すように、該コーナー部に対してインク36が十分に拡散しないという問題が発生する。また、ブラックマトリクス33を形成する際には、一般的にレジストを用いたフォトリソグラフィ工程が使用されており、レジストに含まれる種々の成分により透明基板31の表面に汚染物が付着して、インク36の拡散の妨げとなる場合がある。さらに、透明基板31の表面に比べて、ブラックマトリクス33の側面の撥インク性が極端に高い場合、図4（b）に示すように、ブラックマトリクス33の側面でインク36がはじかれてしまうため、インク36とブラックマトリクス33が接する部分で色が薄くなるという問題が発生する場合もある。

【0024】このような混色や白抜けの問題を解決する手法として、特開平9－203803号においては、ブラックマトリクス（凸部）に囲まれた領域（凹部）が、水に対して20°以下の接触角となるよう親インク化処理された基板を用いることが提案されている。親インク性を付与する方法としては、水溶性のレベリング剤や水溶性の界面活性剤が例示されている。さらに、上述した混色に対する問題を同時に解決するために、凸部の表面をテめ撥インク化処理剤で処理して撥インク性を付与する手法が開示されており、撥インク化処理剤としてフッ素含有シランカップリング剤を用い、フッ素系の溶剤でコートする方法が例示されている。また、この際、凸部の表面層のみを選択的に撥インク化し、凸部の側面を撥インク化しないための手法として、

①凸部自体がそのような性質を生じるよう2種類の材料を積層する、

②凸部以外の部分をレジストで覆って、凸部の上面のみを撥インク化処理する、

③透明基板上にレジスト層を形成し、全面を撥インク化処理した後、フォトリソ工程によりレジスト層をパターニングして凸部を形成する、等の方法が例示されている。

【0025】また、特開平9－230129号においては、同様に、凹部を親インク化処理する方法として、エネルギー線を照射する方法が開示されている。この場合にも、凸部の表面層のみを撥インク化処理する方法として、ガラス基板上に凸部形成用の感光性材料を塗布し、全面を撥インク化処理剤にて処理した後、フォトリソグラフィ工程により感光性材料をパターニングする手法が例示されている。その後、エネルギー線の照射により凸部と凹部を同時に、もしくはどちらかを選択的に親インク化処理するものである。

【0026】しかしながら、これらの方法はいずれも凸部の表面を撥インク化処理した後に凹部を親インク化処理するものであることから、親インク化処理を行う際に撥インク化処理された凸部の表面の撥インク性を低下させてしまうという問題がある。そのため、透明基板表面及びブラックマトリクスの側面においては十分な親インク性を、ブラックマトリクスの上面においては十分な撥インク性をそれぞれ得ることは困難である。

【0027】上記問題は、インクジェット方式によりエレクトロルミネッセンス素子を製造する場合にも同様に生じる。即ち、エレクトロルミネッセンス素子において、例えばR、G、Bの各光を発光する有機半導体材料をインクとして用い、隔壁で囲まれた領域に該インクを付与して画素（発光層）を形成する際に、隣接する発光層間でインクが混じり合った場合、当該発光層では所望の色、輝度の発光が得られないという問題が生じる。また、単一色の発光層であっても、隔壁内に充填するインク量を均一化しているため、隣接画素へインクが流入すると、インク量に不均一性が生じ、輝度ムラとして認識され、問題となる。また、隔壁で囲まれた領域内に十分にインクが拡散しなかった場合には、発光層と隔壁との境界部分で十分な発光輝度が得られないという問題を生じる。尚、以下の記述においては、便宜上、エレクトロルミネッセンス素子を製造する場合においても、隣接する発光層間でのインクの混じり合いを「混色」、発光層と隔壁の境界部でのインクの反発による発光輝度ムラの発生を「白抜け」と記す。

【0028】本発明の課題は、カラーフィルタやエレクトロルミネッセンス素子といった光学素子を、インクジェット方式を利用して簡易なプロセスで安価に製造するに際して、上記問題を解決し、信頼性の高い光学素子を歩留まり良く提供することにある。具体的には、隔壁で

囲まれた領域内にインクを付与する際に、隣接する画素間での混色を防止し、且つ、該領域内でインクを十分に拡散させて白抜けのない画素を形成することにある。本発明ではさらに、該製造方法によって得られた光学素子を用いて、カラー表示特性に優れた液晶素子をより安価に提供することを目的とする。

【0029】

【課題を解決するための手段】本発明の第一は、支持基板上に複数の画素と隣接する画素間に位置する樹脂組成物からなる隔壁とを少なくとも有する光学素子の製造方法であって、支持基板上に、該基板の法線方向の断面が逆テーパー形状の隔壁を形成する工程と、上記隔壁表面にフッ素化処理を施す工程と、インクジェット方式により上記隔壁で囲まれた領域にインクを付与して画素を形成する工程と、を有することを特徴とする光学素子の製造方法である。

【0030】上記本発明の第一は、上記フッ素化処理が、少なくともフッ素原子を含有するガスを導入してプラズマ照射を行うプラズマ処理であること、上記隔壁を、遮光剤を含有する樹脂組成物で形成すること、該遮光剤がカーボンブラックであること、上記フッ素化処理に先立って、隔壁表面及び支持基板表面に親インク処理を施すこと、該親インク化処理が、アルカリ水溶液による洗浄処理、UV洗浄処理、エキシマ洗浄処理、コロナ放電処理、酸素プラズマ処理のいずれかであること、上記インクが少なくとも硬化成分、水、有機溶剤を含有すること、上記インクが着色剤を含有し、画素が着色部であるカラーフィルタを製造すること、上記画素が発光層であるエレクトロルミネッセンス素子を製造すること、を好ましい態様として含むものである。

【0031】また、本発明の第二は、支持基板上に複数の画素と隣接する画素間に位置する隔壁とを少なくとも有し、上記本発明の光学素子の製造方法により製造されたことを特徴とする光学素子である。

【0032】上記本発明の第二は、上記隔壁が遮光層であること、上記支持基板が透明基板であり、上記画素が着色剤を含有するインクで形成された着色部であり、複数色の着色部を備えたカラーフィルタであること、該着色部上に保護層を有すること、表面に透明導電膜を有すること、或いは、上記画素が発光層であり、該発光層を挟んで上下に電極を有するエレクトロルミネッセンス素子であること、を好ましい態様として含むものである。

【0033】さらに本発明の第三は、一対の基板間に液晶を挟持してなり、一方の基板が上記本発明の光学素子の一態様であるカラーフィルタを用いて構成されたことを特徴とする液晶素子である。

【0034】

【発明の実施の形態】本発明の光学素子の製造方法は、支持基板上に形成する隔壁を、基板法線方向の断面が逆テーパー形状、即ち該隔壁の支持基板に接する下面が上面よりも面積が小さい形状になるように形成して、該隔壁表面に該表面の撥インク性を増大させるためのフッ素化処理を施し、該隔壁で囲まれた領域にインクジェット方式によりインクを付与して画素を形成することに特徴を有する。本発明においては、隔壁の断面が逆テーパー形状であることから、フッ素化処理の際に、面積の広い上面がプラズマに対して影となり、隔壁上面に比べて側面の処理程度が低く、結果として該側面の撥インク性が低くなるものと考えられ、従来の順テーパー形状、或いは従来の正方形、長方形の隔壁に比べて、白抜けの発生が抑えられる。また、隔壁上面は十分な撥インク性が発現されるため、混色も同時に防止される。

【0035】尚、本発明において上記「インク」とは、乾燥硬化した後に、例えば光学的、電気的に機能性を有する液体を総称し、従来用いられていた着色材料に限定されるものではない。

【0036】本発明の製造方法で製造される本発明の光学素子としては、カラーフィルタ及びエレクトロルミネッセンス素子が挙げられる。先ず、本発明の光学素子について実施形態を挙げて説明する。

【0037】図8に、本発明の光学素子の一実施形態であるカラーフィルタの一例の断面を模式的に示す。図中、81は支持基板としての透明基板、82は隔壁を兼ねたブラックマトリクス、83は画素である着色部、84は必要に応じて形成される保護層である。本発明のカラーフィルタを用いて液晶素子を構成する場合には、着色部83上或いは、着色部83上に保護層84を形成したさらにその上に、液晶を駆動するためのITO(インジウム・チン・オキサイド)等透明導電材からなる透明導電膜が形成されて提供される場合もある。

【0038】図9に、図8のカラーフィルタを用いて構成された、本発明の液晶素子の一実施形態の断面模式図を示す。図中、87は共通電極(透明導電膜)、88は配向膜、89は液晶、91は対向基板、92は画素電極、93は配向膜であり、図8と同じ部材には同じ符号を付して説明を省略する。

【0039】カラー液晶素子は、一般的にカラーフィルタ側の基板81と対向基板91とを合わせ込み、液晶89を封入することにより形成される。液晶素子の一方の基板91の内側に、TFT(不図示)と画素電極92が マトリクス状に形成されている。また、カラーフィルタ側の基板51の内側には、画素電極92に対向する位置に、R、G、Bが配列するように、カラーフィルタの着色部83が形成され、その上に透明な共通電極87が形成される。さらに、両基板の面内には配向膜88,93が形成されており、液晶分子を一定方向に配列させている。これらの基板は、スペーサー(不図示)を介して対向配置され、シール材(不図示)によって貼り合わされ、その間隙に液晶89が充填される。

【0040】上記液晶素子は、透過型の場合には、基板

９１及び画素電極９２を透明素材で形成し、それぞれの基板の外側に偏光板を接着し、一般的に蛍光灯と散乱板を組み合わせたバックライトを用い、液晶化合物をバックライトの光の透過率を変化させる光シャッターとして機能させることにより表示を行う。また、反射型の場合には、基板９１或いは画素電極９２を反射機能を備えた素材で形成するか、或いは、基板９１上に反射層を設け、透明基板８１の外側に偏光板を設け、カラーフィルタ側から入射した光を反射して表示を行う。

【００４１】また、図１０に、本発明の光学素子の他の実施形態である、有機エレクトロルミネッセンス素子（以下、「ＥＬ素子」と記す）の一例の断面模式図を示す。図中、１０１は支持基板である駆動基板、１０２は隔壁、１０３は画素である発光層、１０４は透明電極、１０６は金属層である。この図では、簡略化のために一つの画素領域のみを示している。

【００４２】駆動基板１０１には、ＴＦＴ（不図示）、配線膜及び絶縁膜等が多層に積層されており、金属層１０６及び発光層１０３毎に配置した透明電極１０４間に発光層単位で電圧を印加可能に構成されている。駆動基板１０１は公知の薄膜プロセスによって製造される。

【００４３】本発明の有機ＥＬ素子の構造については、少なくとも一方が透明または半透明である一対の陽極及び陰極からなる電極間に、樹脂組成物からなる隔壁内に少なくとも発光材料を充填されてなる構成であれば、特に制限はなく、その構造は公知のものを採用することができ、また本発明の主旨を逸脱しない限りにおいて各種の改変を加えることができる。

【００４４】その積層構造は、例えば、

（１）電極（陰極）／発光層／正孔注入層／電極（陽極）

（２）電極（陽極）／発光層／電子注入層／電極（陰極）

（３）電極（陽極）／正孔注入層／発光層／電子注入層／電極（陰極）

（４）電極（陽極または陰極）／発光層／電極（陰極または陽極）

があるが、本発明は上記のいずれの構成の有機化合物層を設けた積層構造体を有するＥＬ素子に対しても適用することができる。

【００４５】上記（１）は２層構造、（３）は３層構造（４）は単層構成と称されるものである。本発明の有機ＥＬ素子はこれらの積層構造を基本とするが、これら以外の（１）から（４）を組み合わせた構造やそれぞれの層を複数有していてもよい。また、カラーフィルタと組み合わせることによって、フルカラー表示を実現しても良い。これらの積層構造からなる本発明の有機ＥＬ素子の形状、大きさ、材質、製造方法等は該有機ＥＬ素子の用途等に応じて適宜選択され、これらについては特に制限はない。

【００４６】本発明の有機ＥＬ素子の発光層に用いられる発光材料は特に限定されず、種々のものを適用することができる。具体的には、低分子蛍光体や高分子蛍光体が好ましく、高分子蛍光体がさらに好ましい。

【００４７】例えば、低分子有機化合物としては、特に限定はないが、ナフタレン及びその誘導体、アントラセン及びその誘導体、ペリレン及びその誘導体、ポリメチン系、キサンテン系、クマリン系、シアニン系などの色素類、８－ヒドロキシキノリン及びその誘導体の金属錯体、芳香族アミン、テトラフェニルシクロペンタジエン及びその誘導体、テトラフェニルブタジエン及びその誘導体等を用いることができる。具体的には、例えば、特開昭５７－５１７８１号、特開昭５９－１９４３９３号公報に記載されているものなど、公知のものが使用可能である。

【００４８】また、発光材料として使用可能な高分子有機化合物としては、特に限定はないが、ポリフェニレンビニレン、ポリアリレン、ポリアルキルチオフェン、ポリアルキルフルオレン等を挙げることができる。

【００４９】尚、本発明の有機ＥＬ素子に用いる高分子蛍光体は、ランダム、ブロックまたはグラフト共重合体であってもよいし、それらの中間的な構造を有する高分子、例えばブロック性を帯びたランダム共重合体であってもよい。蛍光の量子収率の高い高分子蛍光体を得る観点からは完全なランダム共重合体よりブロック性を帯びたランダム共重合体やブロックまたはグラフト共重合体が好ましい。また本発明の有機ＥＬ素子は、薄膜からの発光を利用するので該高分子蛍光体は、固体状態で蛍光を有するものが用いられる。

【００５０】該高分子蛍光体に対する良溶媒としては、クロロホルム、塩化メチレン、ジクロロエタン、テトラヒドロフラン、トルエン、キシレンなどが例示される。高分子蛍光体の構造や分子量にもよるが、通常はこれらの溶媒に０．１重量％以上溶解させることができる。

【００５１】本発明の有機ＥＬ素子において、発光材料を含む層と陰極との間にさらに電子輸送層を設ける場合の電子輸送層中に使用する、或いは正孔輸送材料及び発光材料と混合使用する電子輸送性材料は、陰極より注入された電子を発光材料に伝達する機能を有している。このような電子輸送性材料について特に制限はなく、従来公知の化合物の中から任意のものを選択して用いることができる。

【００５２】該電子輸送性材料の好ましい例としては、ニトロ置換フルオレノン誘導体、アントラキノジメタン誘導体、ジフェニルキノン誘導体、チオピランジオキシド誘導体、複素環テトラカルボン酸無水物、或いはカルボジイミド等を挙げることができる。

【００５３】さらに、フレオレニリデンメタン誘導体、アントラキノジメタン誘導体及びアントロン誘導体、オキサジアゾール誘導体等を挙げることができる。また、

発光層を形成する材料として開示されているが、８－ヒドロキシキノリン及びその誘導体の金属錯体等も電子輸送材料として用いることができる。

【００５４】次に、本発明の一例である積層構造を有する有機ＥＬ素子の代表的な作製方法について述べる。陽極及び陰極からなる一対の電極で、透明または半透明な電極としては、例えば、透明ガラス、透明プラスチック等の透明基板の上に、透明または半透明の電極を形成したものが用いられる。

【００５５】本発明のＥＬ素子において、発光層は一般には適当な結着性樹脂と組み合わせて薄膜を形成する。上記結着剤としては広範囲な結着性樹脂より選択でき、例えばポリビニルカルバゾール樹脂、ポリカーボネート樹脂、ポリエステル樹脂、ポリアリレート樹脂、ブチラール樹脂、ポリスチレン樹脂、ポリビニルアセタール樹脂、ジアリルフタレート樹脂、アクリル樹脂、メタクリル樹脂、フェノール樹脂、エポキシ樹脂、シリコーン樹脂、ポリスルホン樹脂、尿素樹脂等が挙げられるが、これらに限定されるものではない。これらは単独または共重合体ポリマーとして１種または２種以上混合して用いても良い。陽極材料としては仕事関数がなるべく大きなものが良く、例えば、ニッケル、金、白金、パラジウム、セレン、レニウム、イリジウムやこれらの合金、或いは酸化錫、酸化錫インジウム（ＩＴＯ）、ヨウ化銅が好ましい。またポリ（３－メチルチオフェン）、ポリフェニレンスルフィド或いはポリピロール等の導電性ポリマーも使用出来る。

【００５６】一方、陰極材料としては仕事関数が小さな銀、鉛、錫、マグネシウム、アルミニウム、カルシウム、マンガン、インジウム、クロム或いはこれらの合金が用いられる。

【００５７】以下に、図面を参照して本発明の光学素子の製造方法について説明する。

【００５８】図１～図２は本発明の光学素子の製造方法を模式的に示す工程図である。以下に各工程について説明する。尚、以下の工程（ａ）～（ｆ）は図１～図２の（ａ）～（ｆ）に対応する。また、図１、図２の各工程において紙面左側の（ａ－１）～（ｆ－１）は工程中の基板を上方より見た平面模式図、紙面右側の（ａ－２）～（ｆ－２）は（ａ－１）～（ｆ－１）のＡ－Ｂ断面模式図である。図中、１は支持基板、２は樹脂組成物層、３は隔壁、４は隔壁３の開口部、６はインクジェットヘッド、７はインク、８は画素である。

【００５９】工程（ａ）

支持基板１を用意する。支持基板１は、図８に例示したカラーフィルタを製造する場合には透明基板８１であり、一般にはガラス基板が用いられるが、流晶素子を構成する目的においては、所望の透明性、機械的強度等の必要特性を有するものであれば、プラスチック基板なども用いることができる。

【００６０】また、図１０に例示したＥＬ素子を製造する場合には、支持基板１は透明電極１０４を形成した駆動基板１０１であり、図１０の如く当該基板側から発光を観察する場合には、駆動基板１０１にガラス基板などの透明基板を用いる。該基板には後工程で発光層１０３の材料が付着しやすいように、その表面に対して、プラズマ処理、ＵＶ処理、カップリング処理等の表面処理を施すことが好ましい。

【００６１】工程（ｂ）

支持基板１上に、隔壁３を形成するための樹脂組成物層２を形成する。本発明にかかる隔壁３は、図８のカラーフィルタの場合にはブラックマトリクス８２に、図１０のＥＬ素子の場合には隔壁１０２に相当する。該隔壁３は、特にカラーフィルタを製造する場合には、図８の８２で示したように、隣接する画素間を遮光する遮光層とすることが好ましく、その場合、図８の如くブラックマトリクス８２とするか、或いは、ブラックストライプとすることもできる。また、ＥＬ素子を製造する場合にも遮光層とすることが可能である。

【００６２】本発明において、隔壁３を形成するために用いられる樹脂組成物としては、エポキシ系樹脂、アクリル系樹脂、ポリアミドイミドを含むポリイミド系樹脂、ウレタン系樹脂、ポリエステル系樹脂、ポリビニル系樹脂などの感光性または非感光性の樹脂材料を用いることができるが、２５０℃以上の耐熱性を有することが好ましく、その点から、エポキシ系樹脂、アクリル系樹脂、ポリイミド系樹脂が好ましく用いられる。

【００６３】また、かかる隔壁３を遮光層とする場合には、上記樹脂組成物中に、遮光剤を分散せしめた黒色樹脂組成物を用いる。該遮光剤としては、後述するように、フッ素化処理により隔壁３の上面に高い撥インク性を得る上でカーボンブラックを用いることが望ましく、該カーボンブラックとしては、チャネルブラック、ローラーブラック、ディスクブラックと呼ばれているコンタクト法で製造されたもの、ガスファーネストブラック、オイルファーネストブラックと呼ばれているファーネスト法で製造されたもの、サーマルブラック、アセチレンブラックと呼ばれているサーマル法で製造されたものなどを用いることができるが、特に、チャネルブラック、ガスファーネストブラック、オイルファーネストブラックが好ましい。さらに必要に応じて、Ｒ、Ｇ、Ｂの顔料の混合物などを加えても良い。また、一般に市販されている黒色レジストを用いることもできる。必要に応じて高抵抗化した遮光層を用いても良い。

【００６４】樹脂組成物層２は、スピンコート、ロールコート、バーコート、スプレーコート、ディップコート、或いは印刷法等の方法により形成することができる。

【００６５】工程（ｃ）

樹脂組成物層２をパターニングして複数の開口部４を有

する隔壁3を形成する。隔壁3の形状は、図1に示すように、支持基板1の法線方向の断面が逆テーパー形状、即ち、隔壁3の支持基板1に接する下面よりも上面の面積が広くなるように形成する。樹脂組成物層2としてネガ型の感光性材料を用いた場合には、露光を適正より少な目に行い、現像を行うことにより逆テーパー形状とすることができる。

【0066】また、本発明において隔壁3の形成方法としては、図1に示す方法に限定されず、例えば、ポジ型のフォトレジストを用いてリフトオフによって隔壁3を形成することができる。この方法を図7に示す。先ず、支持基板1上にポジ型のフォトレジスト層71を形成し（図7（ａ））、順テーパー形状にパターニングしてフォトレジスト72を形成し（図7（ｂ））、全面にポジ型の樹脂組成物層73を形成し（図7（ｃ））、支持基板1の裏面より露光し、現像処理によりフォトレジスト72及び該レジスト上の樹脂組成物を除去して逆テーパー形状の隔壁3を形成することができる（図7（ｄ））。

【0067】工程（ｄ）

隔壁3の上面にフッ素化処理を施す。当該フッ素化処理は、隔壁3上面に撥インク性を持たせて後工程におけるインク付与時の混色を防止するための処理である。よって、当該処理に先立って、隔壁3表面及び支持基板1表面に親インク化処理を施しておくことが好ましく、該親インク化処理としては、アルカリ水溶液による洗浄処理、UV洗浄処理、エキシマ洗浄処理、コロナ放電処理、酸素プラズマ処理が挙げられる。

【0068】本発明にかかるフッ素化処理の方法としては、工程が簡単であり、樹脂組成物からなる隔壁3の表面を効果的に撥インク化できることから、少なくともフッ素原子を含有するガスを導入してプラズマ照射を行うプラズマ処理が好ましく用いられる。

【0069】本工程において導入する、少なくともフッ素原子を含有するガスとしては、CF_4、CHF_3、C_2F_6、SF_6、C_3F_8、C_5F_8から選択されるハロゲンガスを1種以上用いることが好ましい。特に、C_5F_8（オクタフルオロシクロペンテン）は、オゾン破壊能が0であると同時に、大気寿命が従来のガスに比べて（CF_4：5万年、C_4F_8：3200年）0．98年と非常に短い。従って、地球温暖化係数が90（CO_2=2とした100年積算値）と、従来のガスに比べて（CF_4：6500、C_4F_8：8700）非常に小さく、オゾン層や地球環境保護に極めて有効であり、本発明で使用する上で望ましい。

【0070】さらに、導入ガスとしては、必要に応じて酸素、アルゴン、ヘリウム等のガスを併用しても良い。本工程においては、上記CF_4、CHF_3、C_2F_6、SF_6、C_3F_8、C_5F_8から選択されるハロゲンガスを1種以上とO_2との混合ガスを用いると、本工程において処理される隔壁3表面の撥インク性の程度を制御することが可能になる。但し、当該混合ガスにおいて、O_2の混合比率が30％を超えるとO_2による酸化反応が支配的になり、撥インク性向上効果が妨げられるため、また、O_2混合比率が30％を超えると樹脂に対するダメージが顕著になるため、当該混合ガスを用いる場合にはO_2の混合比率が30％以下の範囲で使用する必要がある。

【0071】また、プラズマの発生方法としては、低周波放電、高周波放電、マイクロ波放電等の方式を用いることができ、プラズマ処理の際の圧力、ガス流量、放電周波数、処理時間等の条件は任意に設定することができる。

【0072】図5、図6に、本発明のプラズマ処理工程に用いることが可能なプラズマ発生装置の模式図を示す。図中、51は上部電極、52は下部電極、53は被処理基板、54は高周波電極である。当該装置は平行平板の2極電極に高周波電圧を印加して、プラズマを発生させる。図5はカソードカップリング方式、図6はアノードカップリング方式の装置を示し、どちらの方式においても、圧力、ガス流量、放電周波数、処理時間等の条件によって、隔壁3表面の撥インク性を所望の程度とすることができる。

【0073】図5、図6に示したプラズマ発生装置において、図5のカソードカップリング方式は処理時間を短くすることが可能であり、当該処理工程に有利である。また、図6のアノードカップリング方式では、必要以上に支持基板1にダメージを与えることがない点で有利である。よって、本工程に用いるプラズマ発生装置は、支持基板1や隔壁3の材料に応じて選択すればよい。

【0074】これら一連の工程により、隔壁3の上面のみがフッ素化処理により高い撥インク性を有し、開口部4に露出した支持基板1表面及び隔壁3の側面は親インク性を有するマトリクスパターン基板を得ることができる。

【0075】工程（ｅ）

インクジェット記録装置を用いて、インクジェットヘッド6よりインク7を隔壁3で囲まれた領域（開口部4）に付与する。インクジェットとしては、エネルギー発生素子として電気熱変換体を用いたバブルジェット（登録商標）タイプ、或いは圧電素子を用いたピエゾジェットタイプ等が使用可能である。また、インク7としては、カラーフィルタの場合には硬化後にR、G、Bの着色部を形成するように各色の着色剤を含むもの、EL素子の場合には、硬化後に電圧印加によって発光する発光層を形成する材料を用いる。いずれの場合も、インク7は硬化成分、水、溶剤を少なくとも含むものが好ましい。以下に、本発明の製造方法によってカラーフィルタを製造する場合に用いるインクの組成についてさらに詳細に説明する。

【0076】〔1〕着色剤

本発明でインク中に含有させる着色剤としては、染料系及び顔料系共に使用可能であるが、顔料を使用する場合には、インク中で均一に分散させるために別途分散剤の添加が必要となり、全固形分中の着色剤比率が低くなってしまうことから、染料系の着色剤が好ましく用いられる。また、着色剤の添加量としては、後述する硬化成分と同量以下であることが好ましい。

【００７７】〔２〕硬化成分

後工程におけるプロセス耐性、信頼性等を考慮した場合、熱処理或いは光照射等の処理により硬化し、着色剤を固定化する成分、即ち架橋可能なモノマー或いはポリマー等の成分を含有することが好ましい。特に、後工程における耐熱性を考慮した場合、硬化可能な樹脂組成物を用いることが好ましい。具体的には、例えば基材樹脂として、水酸基、カルボキシル基、アルコキシ基、アミド基等の官能基を有するアクリル樹脂、シリコーン樹脂；またはヒドロキシプロピルセルロース、ヒドロキシエチルセルロース、メチルセルロース、カルボキシメチルセルロース等のセルロース誘導体或いはそれらの変性物；またはポリビニルピロリドン、ポリビニルアルコール、ポリビニルアセタール等のビニル系ポリマーが挙げられる。さらに、これらの基材樹脂を光照射或いは加熱処理により硬化させるための架橋剤、光開始剤を用いることが可能である。具体的には、架橋剤としては、メチロール化メラミン等のメラミン誘導体が、また光開始剤としては重クロム酸塩、ビスアジド化合物、ラジカル系開始剤、カチオン系開始剤、アニオン系開始剤等が使用可能である。また、これらの光開始剤を複数種混合して、或いは他の増感剤と組み合わせて使用することもできる。

【００７８】〔３〕溶剤

本発明で使用されるインクの媒体としては、水及び有機溶剤の混合溶媒が好ましく使用される。水としては種々のイオンを含有する一般の水ではなく、イオン交換水（脱イオン水）を使用することが好ましい。

【００７９】有機溶剤としては、メチルアルコール、エチルアルコール、ｎ－プロピルアルコール、イソプロピルアルコール、ｎ－ブチルアルコール、ｓｅｃ－ブチルアルコール、ｔｅｒｔ－ブチルアルコール等の炭素数１～４のアルキルアルコール類；ジメチルホルムアミド、ジメチルアセトアミド等のアミド類；アセトン、ジアセトンアルコール等のケトン類またはケトアルコール類；テトラヒドロフラン、ジオキサン等のエーテル類；ポリエチレングリコール、ポリプロピレングリコール等のポリアルキレングリコール類；エチレングリコール、プロピレングリコール、ブチレングリコール、トリエチレングリコール、チオジグリコール、ヘキシレングリコール、ジエチレングリコール等のアルキレン基が２～６個の炭素を含有するアルキレングリコール類；グリセリン類；エチレングリコールモノメチルエーテル、ジエチレングリコールメチルエーテル、トリエチレングリコールモノメチルエーテル等の多価アルコールの低級アルキルエーテル類；Ｎ－メチル－２－ピロリドン、２－ピロリドン等の中から選択することが好ましい。

【００８０】また、上記成分の他に、必要に応じて所望の物性値を持つインクとするために、沸点の異なる２種類以上の有機溶剤を混合して用いたり、界面活性剤、消泡剤、防腐剤等を添加しても良い。

【００８１】工程（ｆ）

熱処理、光照射等必要な処理を施し、インク７中の溶剤成分を除去して硬化させることにより、画素８を形成する。

【００８２】さらに、カラーフィルタの場合には、前記したように、必要に応じて保護層や透明導電膜を形成する。この場合の保護層としては、光硬化タイプ、熱硬化タイプ、或いは光熱併用硬化タイプの樹脂材料、或いは、蒸着、スパック等によって形成された無機膜等を用いることができ、カラーフィルタとした場合の透明性を有し、その後の透明導電膜形成プロセス、配向膜形成プロセス等に耐えうるものであれば使用可能である。また、透明導電膜は、保護層を介さずに着色部上に直接形成しても良い。また、ＥＬ素子の場合には、画素８上に金属層など必要な部材を積層する。

【００８３】

【実施例】（実施例１）

〔ブラックマトリクスの形成〕ガラス基板（コーニング製「１７３７」）上に、カーボンブラックを含有する黒色レジスト（新日鉄化学製「Ｖ－２５９ＢＫレジスト」）を塗布し、露光を不足気味に行った後、現像、ポストベーク処理を行って、膜厚２μｍ、７５μｍ×２２５μｍ、断面が逆テーパー形状の長方形の開口部を有するブラックマトリクスパターン（隔壁）を作製した。

【００８４】〔インクの調整〕下記に示す組成からなるアクリル系共重合体を熱硬化成分として用い、以下の組成にてＲ、Ｇ、Ｂの各インクを調製した。

【００８５】硬化成分

メチルメタクリレート	５０重量部
ヒドロキシエチルメタクリレート	３０重量部
Ｎ－メチロールアクリルアミド	２０重量部

【００８６】Ｒインク

Ｃ．Ｉ．アシッドオレンジ１４８	３．５重量部
Ｃ．Ｉ．アシッドレッド２８９	０．５重量部
ジエチレングリコール	３０重量部
エチレングリコール	２０重量部
イオン交換水	４０重量部
上記硬化成分	６重量部

【００８７】Ｇインク

Ｃ．Ｉ．アシッドイエロー２３	２重量部
亜鉛フタロシアニンスルホアミド	２重量部
ジエチレングリコール	３０重量部

エチレングリコール	20重量部
イオン交換水	40重量部
上記硬化成分	6重量部

【0088】Bインク

C.I.ダイレクトブルー199	4重量部
ジエチレングリコール	30重量部
エチレングリコール	20重量部
イオン交換水	40重量部
上記硬化成分	6重量部

【0089】〔親インク化処理〕上記ブラックマトリクス基板をUV洗浄し、ブラックマトリクス表面及びガラス基板表面を親インク化した。

【0090】〔フッ素化処理〕平行平板型のプラズマ処理装置を用いて、以下の条件にて上記ブラックマトリクス基板にプラズマ処理を行った。

【0091】

使用ガス	CF_4
ガス流量	80sccm
圧力	8Pa
RFパワー	150W
処理時間	60sec

【0092】〔撥インク性の評価〕上記ブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

【0093】ブラックマトリクス上面：125°

ガラス基板表面：15°

【0094】〔着色部の作製〕吐出量20plのインクジェットヘッドを具備したインクジェット記録装置を用い、ブラックマトリクス基板に対して、上記R、G、Bインクを開口部1個あたり200～800plの範囲で100pl おきに量を変化させて付与した。次いで、90℃で10分間、引き続き230℃で30分間の熱処理を行ってインクを硬化させて着色部（画素）とし、インク付与量の異なる7種類のカラーフィルタを作製した。

【0095】〔混色及び白抜けの評価〕得られたカラーフィルタを光学顕微鏡で観察したところ、全てのカラーフィルタにおいて、混色、白抜けは観察されなかった。

【0096】（実施例2）ブラックマトリクス基板の親インク化処理として、UV洗浄に代えて、下記に示す条件で酸素プラズマにてアッシング処理を行った以外は実施例1と同様にしてカラーフィルタを作製した。

【0097】

使用ガス	O_2
ガス流量	80sccm
圧力	8Pa
RFパワー	150W
処理時間	30sec

【0098】〔撥インク性の評価〕フッ素化処理後のブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

【0099】ブラックマトリクス上面：130°

ガラス基板表面：15°

【0100】〔混色及び白抜けの評価〕得られたカラーフィルタを光学顕微鏡で観察したところ、全てのカラーフィルタにおいて、混色、白抜けは観察されなかった。

【0101】（実施例3）ブラックマトリクス基板の親インク化処理として、UV洗浄に代えて、pH=13の水酸化ナトリウム溶液を用いたアルカリ洗浄を行った以外は実施例1と同様にしてカラーフィルタを作製した。

【0102】〔撥インク性の評価〕フッ素化処理後のブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

【0103】ブラックマトリクス上面：125°

ガラス基板表面：18°

【0104】〔混色及び白抜けの評価〕得られたカラーフィルタを光学顕微鏡で観察したところ、全てのカラーフィルタにおいて、混色、白抜けは観察されなかった。

【0105】（実施例4）ブラックマトリクス基板の親インク化処理として、UV洗浄に代えて、エキシマ洗浄を行い、フッ素化処理における使用ガスとして、CF_4に代えて、C_2F_6を用いた以外は実施例1と同様にしてカラーフィルタを作製した。

【0106】〔撥インク性の評価〕フッ素化処理後のブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

【0107】ブラックマトリクス上面：126°

ガラス基板表面：22°

【0108】〔混色及び白抜けの評価〕得られたカラーフィルタを光学顕微鏡で観察したところ、全てのカラーフィルタにおいて、混色、白抜けは観察されなかった。

【0109】（実施例5）ブラックマトリクス基板の親インク化処理として、UV洗浄に代えて、コロナ放電処理を行い、フッ素化処理における使用ガスとして、CF_4に代えて、SF_6を用いた以外は実施例1と同様にしてカラーフィルタを作製した。

【0110】〔撥インク性の評価〕フッ素化処理後のブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

【0111】ブラックマトリクス上面：117°

ガラス基板表面：21°

【0112】〔混色及び白抜けの評価〕得られたカラーフィルタを光学顕微鏡で観察したところ、全てのカラーフィルタにおいて、混色、白抜けは観察されなかった。

【0113】（実施例6）親インク化処理を行わない以外は実施例1と同様にしてカラーフィルタを作製した。

【0114】〔撥インク性の評価〕フッ素化処理後のブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

【0115】ブラックマトリクス上面：120°

ガラス基板表面：50°

【0116】〔混色及び白抜けの評価〕得られたカラーフィルタを光学顕微鏡で観察したところ、インクの付与量が300pl以下のカラーフィルタにおいて白抜けが観察された。また、全てのカラーフィルタにおいて混色は観察されなかった。

【0117】（比較例1）ブラックマトリクス形成工程において適正露光を行い、断面が順テーパー形状のブラックマトリクスを形成した以外は実施例1と同様にしてカラーフィルタを作製した。

【0118】〔撥インク性の評価〕フッ素化処理後のブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

【0119】ブラックマトリクス上面：125°

ガラス基板表面：15°

【0120】〔混色及び白抜けの評価〕得られたカラーフィルタを光学顕微鏡で観察したところ、全てのカラーフィルタにおいて白抜けが観察された。また、全てのカラーフィルタにおいて混色は観察されなかった。

【0121】（比較例2）フッ素化処理を行わなかった以外は実施例1と同様にしてカラーフィルタを作製した。

【0122】〔撥インク性の評価〕ブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

ブラックマトリクス上面：70°

ガラス基板表面：15°

【0123】〔混色及び白抜けの評価〕得られたカラーフィルタを光学顕微鏡で観察したところ、全てのカラーフィルタにおいて白抜けは観察されなかった。又、インクの付与量が400pl以上のカラーフィルター基板において混色が観察された。

【0124】（実施例7）〔透明電極形成〕薄膜プロセスによって形成された、配線膜及び絶縁膜等が多層に積層されてなるTFT駆動基板上に画素（発光層）単位に、透明電極としてITOをスパッタリングにより厚さ40nm形成し、フォトリソ法により、画素形状に従ってパターニングを行う。

【0125】〔隔壁形成〕次に発光層を充填する隔壁を形成する。透明感光性樹脂（富士フィルムオーリン製「CT-2000L」）を塗布し、露光を不足気味に行った後、現像、ポストベーク処理を行って、上記のITO透明電極上に膜厚0．4μm、75μm×225μmの開口部を有する断面が逆テーパー形状の透明なマトリクスパターンを作成した。

【0126】〔親インク化処理〕実施例1と同様に隔壁の形成された基板を UV洗浄により新インク化した。

【0127】〔プラズマ処理〕実施例1と同様の条件で行った。

【0128】〔撥インク性の評価〕ブラックマトリクス基板の純水に対する接触角を測定したところ以下の通りであった。

ITO透明電極上：17°

透明マトリックスパターン上：101°

【0129】〔発光層の形成〕次に前記基板の隔壁内に発光層を充填した。発光層としては、電子輸送性2，5－ビス（5－tert－ブチル－2－ベンゾオキサゾリル）－チオフェン〔蛍光ピーク450nmをもつ電子輸送性青色発光色素であり、発光中心形成化合物の1つである。以下、「BBOT」と記す〕30重量%を、ポリ－N－ビニルカルバゾール〔分子量150，000、関東化学社製、以下、「PVK」と記す〕よりなるホール輸送性ホスト化合物中に分子分散させることができるよう、両者をジクロロエタン溶液に溶解させた。PVK－BBOTのジクロロエタン溶液に、もう1つの発光中心形成化合物であるナイルレッドを0．015モル%となるように溶解し、インクを形成した。該インクをインクジェット法により透明樹脂で囲まれた隔壁内に充填、乾燥し、厚さ200nmの発光層を形成した。このとき、各画素（発光層）は独立し、隔壁間で前記発光材料を含む溶液が隔接画素で混ざることはなかった。又、隔壁内での発光層は均一に分布していた。さらにこの上に、Mg：Ag（10：1）を真空蒸着させて厚さ200nmのMg：Ag陰極を作った。このようにして作ったEL素子の各画素に18Vの電圧を印加したところ、480cd／m²の均一な白色発光が得られた。

【0130】

【発明の効果】以上説明したように、本発明によれば、混色や白抜けのない画素を備えた信頼性の高い光学素子をインクジェット方式により簡易なプロセスによって歩留まり良く製造することができ、着色部内で濃度ムラのないカラーフィルタ、発光層内で発光輝度ムラのないEL素子を歩留まり良く提供することができる。よって、上記カラーフィルタを用いて、カラー表示特性に優れた液晶素子をより安価に提供することができる。

【図面の簡単な説明】

【図1】本発明の光学素子の製造方法の一実施形態の工程図である。

【図2】本発明の光学素子の製造方法の一実施形態の工程図である。

【図3】インクジェット方式による光学素子の製造方法において発生する混色の概念図である。

【図4】インクジェット方式による光学素子の製造方法において発生する白抜けの概念図である。

【図5】本発明の製造方法において用いうるプラズマ発生装置の構成の一例を示す模式図である。

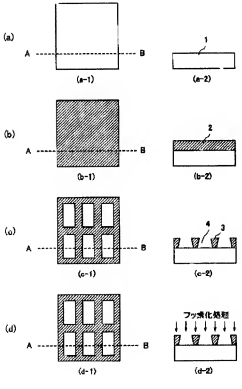
【図6】本発明の製造方法において用いうるプラズマ発生装置の他の構成を示す模式図である。

【図7】本発明にかかる隔壁の他の形成工程を示す断面模式図である。

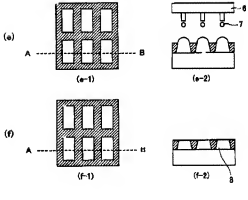
【図8】本発明の光学素子の一実施形態であるカラーフ

ィルタの一例の断面模式図である。
【図9】本発明の液晶素子の一実施形態の断面模式図である。
【図10】本発明の光学素子の他の実施形態であるエレクトロルミネッセンス素子の一例の断面模式図である。
【符号の説明】
1 支持基板
2 樹脂組成物層
3 隔壁
4 開口部
6 インクジェットヘッド
7 インク
8 画素
31 透明基板
33 ブラックマトリクス
36 インク
38 白抜け
51 上部電極
52 下部電極
53 被処理基板
54 高周波電極
71 フォトレジスト層
72 フォトレジスト
73 樹脂組成物層
81 透明基板
82 ブラックマトリクス
83 着色部
84 保護層
87 共通電極
88 配向膜
89 液晶
91 対向基板
92 画素電極
93 配向膜
101 駆動基板
102 隔壁
103 発光層
104 透明電極
106 金属層

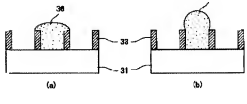
【図1】



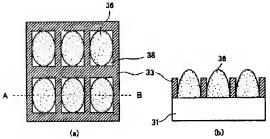
【図2】



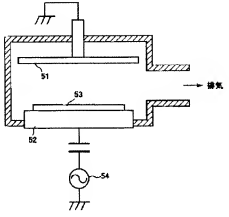
【図3】



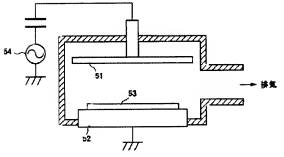
【図4】



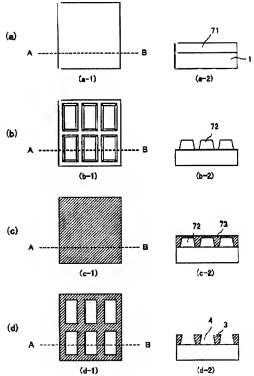
【図5】



【図6】



【図7】



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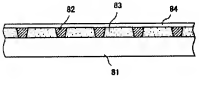
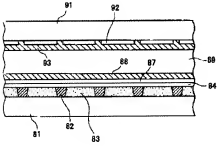
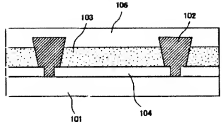


【図9】



【図10】



フロントページの続き

(51)Int.Cl.[7]	識別記号	F I	(参考)
H05B 33/22		H05B 33/22	Z

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Fターム(参考) 2H048 BA02 BA11 BA64 BB01 BB02 BB14 BB22 BB24 BB37 BB41 BB44
2H091 FA02Y FA35Y FB03 FB13 FC12 FC22 FC23 FC27 FD04 FD05 LA12 LA15
3K007 AB02 AB18 BB06 CA01 CA05 CB01 DA00 DB03 EB00 FA01

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]The light filter which is the members forming of the color liquid crystal element by which this invention is used for a color television, a personal computer, a pachinko game stand, etc., And it is related with the liquid crystal element which uses further the light filter which is one of the optical element manufactured by this manufacturing method, and these the optical elements about the manufacturing method which manufactures an optical element called the electroluminescent element provided with two or more luminous layers using an inkjet method.
[0002]
[Description of the Prior Art]In recent years, it is in the tendency which the demand of liquid crystal displays, especially color liquid crystal displays increases with development of a personal computer, especially development of a portable personal computer. However, for the further spread, a cost cut is required, and the demand to the cost cut of a light filter with specific gravity heavy in cost is increasing especially.
[0003]Various methods are tried in order to meet the above-mentioned demand from the former, satisfying the demand characteristics of a light filter, but the method of still satisfying all the demand characteristics is not established. Each method is explained below.
[0004]A primary method is a staining technique. After a staining technique forms first the water-soluble polymer material layer which is the material for dyeing on a transparent substrate and patterns this after desired shape according to a photolithography process, it obtains the pattern which immersed the obtained pattern in the dyeing bath and was colored. By repeating this process 3 times, the coloring layer which consists of a coloring section of three colors of R (red), G (green), and B (blue) is formed.
[0005]The second method is a pigment dispersion method and is performed recent years most briskly. This method obtains a monochromatic pattern by forming the photosensitive resin layer which distributed paints and patterning this on a transparent substrate, first. By repeating this process 3 times, the coloring layer which consists of a coloring section of three colors of R, G, and B is formed.
[0006]The third methods include an electrodeposition process. This method patterns a transparent electrode on a transparent substrate first, immerses in the electropainting liquid into which it went, such as paints, resin, and an electrolysis solution, and electrodeposits the first color. This process is repeated 3 times, the coloring layer which consists of a coloring section of three colors of R, G, and B is formed, and it calcinates at the end.
[0007]As the fourth method, paints are distributed to heat-hardened type resin, and after distinguishing R, G, and B by different color with by repeating printing 3 times, a coloring layer is formed by making resin heat-harden. Also in which method, it is common to form a protective layer on a coloring layer.

[0008]The point common to these methods is repeating the same process 3 times, in order to color three colors of R, G, and B, and becoming a high cost. It also has the problem that the yield falls, so that there are many routing counters. In an electrodeposition process, since the pattern shape which can be formed is limited, application is difficult for the composition of the liquid crystal element of the TFT type (TFT, i.e., the active-matrix-driven method using the thin film transistor as a switching element) in the present art.
[0009]Since definition of print processes is bad, they are unsuitable for the pattern formation of a fine pitch.
[0010]The manufacturing method of the light filter using an inkjet method is briskly examined in recent years in order to compensate the above faults. There is an advantage that the method using an inkjet method has a simple manufacturing process, and it is low cost.
[0011]On the other hand, an inkjet method is applicable not only to manufacture of a light filter but manufacture of an electroluminescent element.
[0012]An electroluminescent element the thin film containing the inorganic matter of fluorescence, and an organic compound, It is an element which has the composition inserted by the negative pole and the anode, makes an exciton generate by making an electron and an electron hole (hole) pour in and recombine with the above-mentioned thin film, and is made to emit light using discharge of the fluorescence at the time of this exciton being deactivated. An inkjet method can give the fluorescence material used for such an electroluminescent element on the substrate which made elements, such as TFT, for example, a luminous layer can be formed, and an element can be constituted.
[0013]
[Problem(s) to be Solved by the Invention]As described above, since the inkjet method can plan simplification and the cost reduction of a manufacturing process, it is applied to manufacture of optical elements, such as a light filter and an electroluminescent element. However, in manufacture of such an optical element, there is a problem called "mixed colors" and "white omission" as a problem peculiar to an inkjet method. Hereafter, the case where a light filter is manufactured is mentioned as an example, and is explained.
[0014]"Mixed colors" is obstacles generated when ink is mixed between the pixels (coloring section) of an adjoining different color. It is necessary to the capacity of the opening of a black matrix to give the ink which has one several times - tens times the volume of this by using a black matrix as a septum in the manufacturing method of the light filter which gives ink to the opening of this black matrix and forms a coloring section. In the case where there is comparatively little volume of the ink with high solids concentration contained in ink, such as colorant and a hardening component, case [ink] namely, given, Since a black matrix can fully function as a septum and ink can be held in the opening of this black matrix, the given ink overcomes a black matrix and does not reach even the coloring section of an adjoining different color. However, since ink overflows exceeding the black matrix used as a septum when the solids concentration in ink is low (i.e., when it is necessary to give a lot of ink), mixed colors will occur between adjoining coloring sections. Since it is stabilized from the nozzle of an ink jet head, there is a limit in the viscosity of the ink in which the regurgitation is possible and there is a limit also in the concentration of the solid content contained in ink especially, the art for avoiding mixed colors is required.
[0015]Then, the method of preventing mixed colors using the wettable difference of the ink between a coloring section and a septum is proposed. For example, in JP,59-75205,A, in order to prevent ink from spreading out of an object region, the method of forming a nonproliferation pattern by a bad wettable substance is proposed, but concrete art is not indicated. On the other hand, in JP,4-123005,A, the method of patterning the big silicone rubber layer of water-repellent ** oil repellency operation as a concrete technique, and using as the bridge wall for mixed-colors prevention is proposed. In JP,5-241011,A or JP,5-241012,A, a silicone rubber layer is similarly formed on the black matrix used as a light shielding layer, and the technique used as a septum for mixed-colors

prevention is indicated.
[0016]When the ink of the quantity far exceeding the height of a septum is given according to these methods, in order that the surface layer of a septum may show ink repellency, ink can be crawled, even the coloring section which adjoins exceeding a septum cannot be attained to, and mixed colors can be prevented effectively.
[0017]The key map is shown in drawing 3. The black matrix in which 31 served as the transparent substrate among the figure, and 33 served as the septum, and 36 are ink. When the upper surface of the black matrix 33 has ink repellency, as shown in drawing 3 (b), the given ink 36 is held in the opening of the black matrix 33, and does not reach even an adjoining coloring section. However, when the ink repellency of the upper surface of the black matrix 33 is low, as shown in drawing 3 (a), the given ink 36 will be mixed with the ink given to the opening which gets wet, and spread and adjoins even on the black matrix 33.
[0018]Generally the ink repellency which was [which uses a fluorine compound] more excellent in rather than can be obtained using a silicon compound. For example, in JP,2000-35511,A, the resist pattern of a positive type is formed on a shade part, the method of applying a ** ink-ized processing agent on this pattern further is indicated, and using a fluorine compound is indicated as a ** ink-ized processing agent. However, in the case of this method, it is necessary to remove the positive type resist pattern provided on the shade part after coloring section formation but, and when removing a resist pattern, problems, such as the dissolution of a pixel, exfoliation, and swelling, may be produced.
[0019]The method of plasma-izing the reactant gas of a fluorine compound to JP,6-65408,A, and processing it to it as the technique of fluorinating the surface of a resin layer, is proposed. As an example which applied this art to the light filter, In JP,11-271753,A, it is considered as the multilayer structure of the lower layer which has compatibility for a septum to ink, and the upper layer which has non-compatibility, and the method of carrying out plasma treatment as the technique of making the upper layer non-compatibility to ink by the gas containing a fluorine compound is indicated.
[0020]However, each technique mentioned above multilayers a septum, and since it needs to carry out multiple-times operation of the photolithography process, it has the problem of causing complication of a process, a cost hike, and by extension, yield lowering.
[0021]On the other hand, a "white omission" is an obstacle which the mainly given ink originates in the ability not to be spread enough and uniformly in the field surrounded by the septum, and generates, and causes display failure called the fall of color unevenness or contrast.
[0022]The key map of a white omission is shown in drawing 4. The same numerals were given to the same member as drawing 3 among the figure. 38 is a white omission portion.
[0023]In the light filter for recent-years and TFT type liquid crystal elements, In order to be the purpose of protecting TFT from outdoor daylight, or to enlarge a numerical aperture and to obtain a bright display, The opening configuration of the black matrix 33 is complicated, and since what has two or more corner parts is generally used, as shown in drawing 4 (a), the problem that the ink 36 is not fully spread to this corner part occurs. When forming the black matrix 33, the photolithography process which generally used resist is used, a contaminant may adhere to the surface of the transparent substrate 31 by various ingredients contained in resist, and it may become the hindrance of diffusion of the ink 36. Since the ink 36 will be crawled on the side of the black matrix 33 as shown in drawing 4 (b) when the ink repellency of the side of the black matrix 33 is extremely high compared with the surface of the transparent substrate 31, The problem that a color becomes thin in the portion which the ink 36 and the black matrix 33 touch may occur.
[0024]Using the substrate parent-ink--ization-processed so that the field (crevice) surrounded by the black matrix (heights) might serve as an angle of contact of 20 degrees or less to water in JP,9-203803,A as the technique of solving the problem of such mixed colors or a white omission is proposed. As a method of giving parent ink nature, a water-soluble leveling agent and water-soluble surface-active agent are illustrated. In order to solve simultaneously the problem over the mixed

colors mentioned above, the technique of processing the surface of heights by a ** ink-ized processing agent beforehand, and giving ink repellency is indicated, and the method of carrying out a coat with the solvent of a fluorine system is illustrated, using a fluoride content silane coupling agent as a ** ink-ized processing agent. As a technique for forming only the surface layer of heights into ** ink selectively, and not forming the side of heights into ** ink in this case, **. Laminate two kinds of materials so that the heights themselves may produce such character. ** after forming a regist layer on ** transparent substrate which covers portions other than heights by resist, and **-ink--ization-processes only the upper surface of heights and **-ink--ization-processing the whole surface, a regist layer is patterned according to a photolitho step, and heights are formed -- the method of ** is illustrated.

[0025]In JP,9-230129,A, it is similarly considered as the method of parent-ink--ization-processing a crevice, and the method of irradiating with an energy line is indicated. Also in this case, after applying the photosensitive material for glass substrate convex part formation by making only the surface layer of heights into the method of **-ink--ization-processing and processing the whole surface in a ** ink-ized processing agent, the technique of patterning a photosensitive material according to a photolithography process is illustrated. Then, either is selectively parent-ink--ization-processed simultaneous in heights and a crevice by the exposure of an energy line.

[0026]However, since each of these methods parent-ink--ization-processes a crevice after **-ink--ization-processing the surface of heights, when they performs parent ink-ized processing, they has the problem of reducing the ink repellency of the surface of the **-ink--ization-processed heights. Therefore, it is difficult to obtain sufficient ink repellency for sufficient parent ink nature in the upper surface of a black matrix in a transparent substrate surface and the side of a black matrix, respectively.

[0027]The above-mentioned problem is similarly produced, when manufacturing an electroluminescent element with an inkjet method. Namely, in an electroluminescent element, the organic semiconductor material which emits light in each light of R, G, and B is used as ink, When giving this ink to the field surrounded by the septum, forming a pixel (luminous layer) in it and ink is mixed between adjoining luminous layers, in the luminous layer concerned, the problem that a desired color and luminescence of luminosity are not obtained arises. Since the ink quantity with which it is filled up in a septum is equalized even if it is a luminous layer of a single color, if ink flows into an adjacent pixel, heterogeneity will arise in ink quantity, and it will be recognized as brightness unevenness, and will become a problem. When ink is not fully spread in the field surrounded by the septum, the problem that light emitting luminance sufficient by the boundary part of a luminous layer and a septum is not obtained is produced. In the following description, for convenience, when manufacturing an electroluminescent element, generating of the light-emitting-luminance nonuniformity according mixture **** of the ink between adjoining luminous layers to rebounding of the ink in the boundary part of "mixed colors", a luminous layer, and a septum is described as a "white omission."

[0028]The technical problem of this invention faces optical elements, such as a light filter and an electroluminescent element, using an inkjet method manufacturing cheaply in a simple process, solves the above-mentioned problem, and there is in providing a reliable optical element with the sufficient yield. When specifically giving ink in the field surrounded by the septum, it is in forming the pixel which prevents the mixed colors between the adjoining pixels, and fully diffuses ink in this field, and does not have a white omission. It aims at providing more cheaply the liquid crystal element excellent in color display properties further using the optical element obtained by this manufacturing method in this invention.

[0029]

[Means for Solving the Problem]It is a manufacturing method of an optical element which has a septum which consists of a resin composition located on a supporting board between two or more pixels and an adjoining pixel at least the first of this invention, A process at which a section of a

normal line direction of this board forms a septum of reverse tapered shape on a supporting board, It is a manufacturing method of an optical element having a process of performing fluorination processing to the above-mentioned partition surface, and the process of giving ink to a field surrounded by the above-mentioned septum by an inkjet method, and forming a pixel in it.
[0030]It is the plasma treatment which the above-mentioned fluorination processing introduces gas which contains a fluorine atom at least the first of above-mentioned this invention, and performs plasma irradiation, This shielding agent is [forming the above-mentioned septum with a resin composition containing a shielding agent,] carbon black, In advance of the above-mentioned fluorination processing, parent ink-ized processing is performed to a partition surface and the supporting board surface, This parent ink-ized processing is washing processing by an alkaline aqueous solution, UV washing processing, excimer washing processing, corona discharge treatment, or oxygen plasma treatment, The above-mentioned ink's containing a hardening component, water, and an organic solvent at least and the above-mentioned ink contain colorant, and it includes as a desirable mode that a pixel manufactures a light filter which is a coloring section, and that the above-mentioned pixel manufactures an electroluminescent element which is a luminous layer.
[0031]The second of this invention is an optical element which having a septum located on a supporting board between two or more pixels and an adjoining pixel at least, and manufacturing by a manufacturing method of an optical element of above-mentioned this invention.
[0032]The above-mentioned septum's being a light shielding layer and the above-mentioned supporting board are transparent substrates, the second of above-mentioned this invention is the coloring section formed in ink in which the above-mentioned pixel contains colorant, and it is the light filter provided with a coloring section of a plural color, Having a protective layer on this coloring section, having a transparent conducting film on the surface, or the above-mentioned pixel is a luminous layer, and it includes as a desirable mode that it is an electroluminescent element which has an electrode up and down on both sides of this luminous layer.
[0033]Furthermore, a liquid crystal is pinched between substrates of the third couple of this invention, and it is a liquid crystal element to which one substrate is characterized by being constituted using a light filter which is one mode of an optical element of above-mentioned this invention.
[0034]
[Embodiment of the Invention]The manufacturing method of the optical element of this invention forms the septum formed on a supporting board so that the undersurface where the section of a substrate normal line direction touches the supporting board of reverse tapered shape, i.e., this septum, may become the shape where area is smaller than the upper surface, It has the feature to perform fluorination processing for increasing the ink repellency of this surface to this partition surface, and for an inkjet method give ink to the field surrounded by this septum, and form a pixel. In this invention, from the section of a septum being reverse tapered shape in the case of fluorination processing. It is thought that the upper surface with a large area serves as a shadow to plasma, the processing grade of the side is low compared with the septum upper surface, and the ink repellency of this side becomes low as a result, and generating of a white omission is suppressed compared with the septum of the conventional forward tapered shape shape or the conventional square, and a rectangle. Since ink repellency with the sufficient septum upper surface is revealed, mixed colors are also prevented simultaneously.
[0035]After carrying out dry hardening of the above "ink" in this invention, the fluid which has functionality optically and electrically, for example is named generically, and it is not limited to the coloring material used conventionally.
[0036]A light filter and an electroluminescent element are mentioned as an optical element of this invention manufactured with the manufacturing method of this invention. First, an embodiment is mentioned and described about the optical element of this invention.
[0037]The section of an example of the light filter which is one embodiment of the optical element

of this invention is typically shown in drawing 8. The black matrix in which 81 served as the transparent substrate as a supporting board among the figure, and 82 served as the septum, the coloring section whose 83 is a pixel, and 84 are protective layers formed if needed. In constituting a liquid crystal element using the light filter of this invention, The transparent conducting film which consists of transparent conducting materials, such as ITO (indium tin oxide) for forming the protective layer 84 on the coloring section 83 or the coloring section 83, and driving [**s] a liquid crystal on it, may be formed and provided.

[0038]The cross section of one embodiment of the liquid crystal element of this invention constituted by using the light filter of drawing 8 for drawing 9 is shown. Among a figure, as for a common electrode (transparent conducting film) and 88, a counter substrate and 92 are orienting films a picture element electrode and 93, a liquid crystal and 91 give the same numerals to the same member as drawing 8, and, as for 87, an orienting film and 89 omit explanation.

[0039]A color liquid crystal element generally doubles the substrate 81 and the counter substrate 91 by the side of a light filter, and is formed by enclosing the liquid crystal 89. Inside one substrate 91 of a liquid crystal element, TFT (un-illustrating) and the picture element electrode 92 are formed at matrix form. The coloring section 83 of a light filter is formed inside the substrate 51 by the side of a light filter, and the transparent common electrode 87 is formed on it so that R, G, and B may arrange in the position which counters the picture element electrode 92. The orienting films 88 and 93 are formed in the field of both boards, and the certain direction is made to arrange a liquid crystal element. The placed opposite of these substrates is carried out via a spacer (un-illustrating), they are stuck by the sealant (un-illustrating), and the gap is filled up with the liquid crystal 89.

[0040]In a transmission type, the above-mentioned liquid crystal element forms the substrate 91 and the picture element electrode 92 for a transparent raw material, A polarizing plate is pasted up on the outside of each substrate, and it displays by operating a liquid crystal compound as an optical shutter to which the transmissivity of the light of a back light is changed using the back light which generally combined the fluorescent lamp and the scattered plate. In a reflection type, the substrate 91 or the picture element electrode 92 is formed for the raw material provided with the reflex function, or a reflecting layer is provided on the substrate 91, a polarizing plate is provided in the outside of the transparent substrate 81, and it displays by reflecting the light which entered from the light filter side.

[0041]The cross section of an example of an organic electroluminescence element (it is hereafter described as a "EL element") which are other embodiments of the optical element of this invention is shown in drawing 10. A transparent electrode and 106 are metal layers among a figure the driving substrate which is a supporting board 101, the luminous layer whose 102 is a pixel a septum and 103, and 104. This figure shows only one picture element region for simplification.

[0042]TFT (un-illustrating), a wiring film, an insulator layer, etc. are laminated by the multilayer, and between the transparent electrodes 104 arranged every metal layer 106 and luminous layer 103, per luminous layer, it is constituted by the driving substrate 101 so that impression of voltage is possible. The driving substrate 101 is manufactured by a publicly known thin film process.

[0043]About the structure of the organic EL device of this invention, if at least one side is the composition which it comes at least to fill up a luminescent material in the septum which becomes inter-electrode [which consists of the anode and the negative pole of a transparent or translucent couple] from a resin composition, Unless there is no restriction in particular, and the structure can adopt a publicly known thing and it deviates from the main point of this invention, various kinds of changes can be added.

[0044]The laminated structure is (1) electrode (negative pole) / luminous layer / hole injection layer / electrode (anode), for example.

(2) An electrode (anode) / luminous layer / electronic injection layer / electrode (negative pole)

(3) An electrode (anode) / hole injection layer / luminous layer / electronic injection layer / electrode (negative pole)

(4) An electrode (anode or negative pole) / luminous layer / electrode (negative pole or anode) ****** can apply this invention also to the EL element which has the laminated structure body which provided the organic compound layer of which above-mentioned composition.
[0045]The above (1) is called two-layer structure and a three-tiered structure (4) is called monolayer composition (3). Although the organic EL device of this invention is based on these laminated structures, two or more owners of the structure which combined (1) to (4) other than these, or each layer may be carried out. A full color display may be realized by combining with a light filter. The shape of the organic EL device of this invention which consists of these laminated structures, a size, construction material, a manufacturing method, etc. are suitably chosen according to the use of this organic EL device, etc., and there is no restriction in particular about these.
[0046]The luminescent material in particular used for the luminous layer of the organic EL device of this invention is not limited, but can apply various things. A low molecule fluorescent substance and a polymeric fluorescent substance are preferred, and, specifically, a polymeric fluorescent substance is still more preferred.
[0047]Although there is no limitation in particular as a low molecule organic compound, for example, naphthalene and its derivative, Anthracene and its derivative, perylene and its derivative, a poly methine system, Coloring matter, such as a xanthene series, a coumarin series, and a cyanine system, 8-hydroxyquinoline and the metal complex of the derivative, aromatic amine, a tetraphenylcyclopentadiene and its derivative, tetraphenylbutadiene, its derivative, etc. can be used. Specifically, it is usable in publicly known things, such as what is indicated to JP,57-51781,A and JP,59-194393,A, for example.
[0048]Although there is no limitation in particular as a polymers organic compound usable as a luminescent material, polyphenylene vinylene, polyallylene, polyalkylthio Foehn, a poly alkyl fluorene, etc. can be mentioned.
[0049]The polymeric fluorescent substance used for the organic EL device of this invention may be randomness, a block, or a graft copolymer, and may be the polymers which have those interim structures, for example, the random copolymer which is tinged with block nature. From a viewpoint of obtaining a polymeric fluorescent substance with a high quantum yield of fluorescence, a random copolymer, and the block or graft copolymer which is tinged with block nature is more preferred than a perfect random copolymer. Since the organic EL device of this invention uses luminescence from a thin film, that in which this polymeric fluorescent substance has fluorescence by a solid state is used.
[0050]As a good solvent to this polymeric fluorescent substance, chloroform, a methylene chloride, a dichloroethane, a tetrahydrofuran, toluene, xylene, etc. are illustrated. Although based also on the structure and the molecular weight of a polymeric fluorescent substance, it can be made to usually dissolve in these solvents 0.1% of the weight or more.
[0051]In the organic EL device of this invention, the electron-transport-property material which uses it into the electron transport layer in the case of providing an electron transport layer further between the layer and the negative pole containing a luminescent material, or carries out mixed use with a hole transporting material and a luminescent material has the function to transmit the electron poured in from the negative pole to a luminescent material. There is no restriction in particular about such an electron-transport-property material, and arbitrary things can be conventionally chosen and used out of a publicly known compound.
[0052]As a desirable example of this electron-transport-property material, a nitration fluorenone derivative, an anthra quinodimethane derivative, a diphenyl quinone derivative, a thiopyrandioxide derivative, a heterocyclic tetracarboxylic anhydride, or a carbodiimide can be mentioned.
[0053]A FURE0RENIRIDEN methane derivative, an anthra quinodimethane derivative and the Antron derivative, an oxadiazole derivative, etc. can be mentioned. Although indicated as a material which forms a luminous layer, the metal complex of 8-hydroxyquinoline and its derivative, etc. can be used as an electron transport material.

[0054]Next, the typical manufacturing method of the organic EL device which has a laminated structure which is an example of this invention is described. By the electrode of the couple which consists of the anode and the negative pole, what formed the transparent or translucent electrode, for example on transparent substrates, such as clear glass and a transparent plastic, is used as a transparent or translucent electrode.
[0055]Generally in the EL element of this invention, a luminous layer forms a thin film combining suitable bending resin. Can choose from bending resin wide range as the above-mentioned binder, and For example, polyvinyl-carbazole resin, Polycarbonate resin, polyester resin, polyarylate resin, butyral resin, Although polystyrene resin, polyvinyl-acetal resin, diallyl phthalate resin, an acrylic resin, methacrylic resin, phenol resin, an epoxy resin, silicone resin, polysulfone resin, urea resin, etc. are mentioned, it is not limited to these. as that these are independent or copolymer -- one sort -- or two or more sorts may be mixed and it may use. What has as big a work function as an anode material as possible is good, for example, nickel, gold, platinum, palladium, selenium, a rhenium, iridium, these alloys or tin oxide, tin oxide indium (ITO), and copper iodide are preferred. Conductive polymers, such as poly (3-methylthiophene), a polyphenylene sulfide, or polypyrrole, can also be used.
[0056]On the other hand, silver with a work function small as a cathode material, lead, tin, magnesium, aluminum, calcium, manganese, indium, chromium, or these alloys are used.
[0057]Below, with reference to drawings, the manufacturing method of the optical element of this invention is explained.
[0058]Drawing 1 - drawing 2 are process drawings showing the manufacturing method of the optical element of this invention typically. Each process is explained below. Following process (a) - (f) corresponds to (a) - (f) of drawing 1 - drawing 2. In each process of drawing 1 and drawing 2, - (a-2) (f-2) the mimetic diagram in which - (a-1) on the left-hand side of space (f-1) looked at the substrate in process from the upper part, and on the right-hand side of space is an A-B cross section of - (a-1) (f-1). the inside of a figure, and 1 -- as for the opening of the septum 3, and 6, a resin composition layer and 3 are [ink and 8] pixels an ink jet head and 7 a septum and 4 a supporting board and 2.
[0059] Process (a)
The supporting board 1 is prepared. Although the supporting board 1 is the transparent substrate 81 when manufacturing the light filter illustrated to drawing 8, and a glass substrate is generally used, if it has the required characteristics, such as desired transparency and a mechanical strength, a plastic plate etc. can be used in the purpose of constituting a liquid crystal element.
[0060]When manufacturing the EL element illustrated to drawing 10, the supporting board 1 is the driving substrate 101 in which the transparent electrode 104 was formed, and in observing luminescence from the substrate side concerned like drawing 10, it uses transparent substrates, such as a glass substrate, for the driving substrate 101. It is preferred to perform surface treatments, such as plasma treatment, UV processing, and coupling processing, to the surface so that the material of the luminous layer 103 may adhere to this substrate easily in a post process.
[0061] Process (b)
The resin composition layer 2 for forming the septum 3 on the supporting board 1 is formed. In the case of the light filter of drawing 8, the septum 3 concerning this invention corresponds at the black matrix 82, and, in the case of the EL element of drawing 10, corresponds at the septum 102. When manufacturing a light filter, as for this especially septum 3, it is preferred to consider it as the light shielding layer which shades between the adjoining pixels, as 82 of drawing 8 showed, and in that case, like drawing 8, it can be made into the black matrix 82, or can also be used as a black stripe. Also when manufacturing an EL element, it is possible to consider it as a light shielding layer.
[0062]As a resin composition used in this invention in order to form the septum 3, Although the resin material of photosensitivity or nonphotosensitivity, such as epoxy system resin, acrylic resin, polyimide system resin containing polyamidoimide, urethane system resin, polyester system resin,

and polyvinyl system resin, can be used, It is preferred to have the heat resistance of not less than 250 **, and epoxy system resin, acrylic resin, and polyimide system resin are preferably used from the point.

[0063]In making this septum 3 into a light shielding layer, it uses the black resin constituent which made the shielding agent distribute into the above-mentioned resin composition. It is desirable to use carbon black as this shielding agent, when obtaining high ink repellency on the upper surface of the septum 3 by fluorination processing so that it may mention later, and as this carbon black, What was manufactured by the contacting method currently called channel black, roller black, and disk black, Although what was manufactured by thermal ** currently called what manufactured by the fur nesting method currently called gas fur nest black and oil fur nest black, thermal black, and acetylene black can be used, In particular, channel black, gas fur nest black, and oil fur nest black are preferred. Furthermore, the mixture of the paints of R, G, and B, etc. may be added if needed. The black resist generally marketed can also be used. The light shielding layer high-resistance-ized if needed may be used.

[0064]The resin composition layer 2 can be formed by methods, such as a spin coat, a roll coat, a bar coat, a spray coat, dip coating, or print processes.

[0065] Process (c)

The septum 3 which patterns the resin composition layer 2 and has two or more openings 4 is formed. As shown in drawing 1, the shape of the septum 3 is formed so that an area on top may become large rather than the undersurface where the section of the normal line direction of the supporting board 1 touches the reverse tapered shape 1, i.e., the supporting board of the septum 3. When the photosensitive material of a negative mold is used as the resin composition layer 2, it can be considered as reverse tapered shape by exposing to a properly fewer eye and developing negatives to it.

[0066]It is not limited to the method shown in drawing 1 as a formation method of the septum 3 in this invention, for example, the septum 3 can be formed by a lift off using the photoresist of a positive type. This method is shown in drawing 7. First, the photoresist layer 71 of a positive type is formed on the supporting board 1 (drawing 7 (a)), Pattern after forward tapered shape shape and the photoresist 72 is formed (drawing 7 (b)), The resin composition layer 73 of a positive type is formed in the whole surface (drawing 7 (c)), it can expose from the rear face of the supporting board 1, a development can remove the resin composition on the photoresist 72 and this resist, and the septum 3 of reverse tapered shape can be formed (drawing 7 (d)).

[0067] Process (d)

Fluorination processing is performed to the upper surface of the septum 3. The fluorination processing concerned is processing for giving ink repellency to the septum 3 upper surface, and preventing the mixed colors at the time of the ink grant in a post process. Therefore, in advance of the processing concerned, it is preferred to perform parent ink-ized processing to the septum 3 surface and the supporting board 1 surface, and the washing processing by an alkaline aqueous solution, UV washing processing, excimer washing processing, corona discharge treatment, and oxygen plasma treatment are mentioned as this parent ink-ized processing.

[0068]As the method of the fluorination processing concerning this invention, a process is easy and the plasma treatment which introduces the gas which contains a fluorine atom at least, and performs plasma irradiation from the ability of-izing of the surface of the septum 3 which consists of resin compositions to be carried out [** ink] effectively is used preferably.

[0069]As gas which is introduced in this process and which contains a fluorine atom at least, It is preferred to use one or more sorts of halogen gas chosen from CF_4, CHF_3, C_2F_6, SF_6, C_3F_8, and C_5F_8. Especially C_5F_8 (octafluoro cyclopentene) has an atmosphere life dramatically as short as 0.98 (CF_4: 50,000 years, C_4F_8:3200 year) compared with conventional gas, while ozone-crack ability is 0. Therefore, a global warming potential is dramatically (CF_4:6500, C_4F_8:8700) small compared with 90

(100-year integrated value set to CO_2=2), and conventional gas, and very effective in an ozone layer or earth environment protection, and it is desirable when using it by this invention.
[0070]As introductory gas, gas, such as oxygen, argon, and helium, may be used together if needed. In this process, the above-mentioned CF_4, CHF_3, C_2F_6, It becomes possible to control the grade of the ink repellency of the septum 3 surface which will be processed in this process in the halogen gas chosen from SF_6, C_3F_8, and C_5F_8 if the mixed gas of one or more sorts and O_2 is used. However, since the oxidation reaction by O_2 will become dominant and an ink repellency improved effect will be barred in the mixed gas concerned, if the mixing ratio of O_2 exceeds 30%, Since the damage to resin will become remarkable if O_2 mixing ratio exceeds 30%, to use the mixed gas concerned, the mixing ratio of O_2 needs to use it in 30% or less of range.
[0071]As a generation method of plasma, methods, such as low frequency wave discharge, high frequency discharge, and microwave discharge, can be used, and conditions, such as a pressure in the case of plasma treatment, a gas mass flow, discharge frequency, and processing time, can be set up arbitrarily.
[0072]The mimetic diagram of the plasma generator which can be used for the plasma treatment process of this invention is shown in drawing 5 and drawing 6. As for an upper electrode and 52, a processed board and 54 are RF electrodes a lower electrode and 53 51 among a figure. The device concerned impresses high frequency voltage to 2 pole electrodes of a parallel plate, and generates plasma. Drawing 5 can show a cathode coupling method, drawing 6 can show the device of an anode coupling method, and ink repellency of the septum 3 surface can be made into a desired grade by conditions, such as a pressure, a gas mass flow, discharge frequency, and processing time, also in which method.
[0073]In the plasma generator shown in drawing 5 and drawing 6, the cathode coupling method of drawing 5 can shorten processing time, and is advantageous to the down stream processing concerned. It is advantageous at the point of not giving a damage to the supporting board 1 in the anode coupling method of drawing 6 more than needed. Therefore, what is necessary is just to choose the plasma generator used for this process according to the material of the supporting board 1 or the septum 3.
[0074]By the process of these series, only the upper surface of the septum 3 has high ink repellency by fluorination processing, and the supporting board 1 surface exposed to the opening 4 and the side of the septum 3 can obtain the matrix pattern substrate which has parent ink nature.
[0075] Process (e)
The ink 7 is given to the field (opening 4) surrounded by the septum 3 from the ink jet head 6 using an ink-jet recording device. As an ink jet, it is usable in the bubble jet (registered trademark) type which used the electric thermal-conversion object as an energy generation element, or the piezo jet type using a piezoelectric element. In the case of what in the case of a light filter contains colorant of each color so that the coloring section of R, G, and B may be formed after hardening, and an EL element, as the ink 7, the material which forms the luminous layer which emits light by voltage impressing after hardening is used. As for the ink 7, in any case, what contains a hardening component, water, and a solvent at least is preferred. It explains still in detail about the presentation of the ink used for it when manufacturing a light filter to below with the manufacturing method of this invention.
[0076][1]As colorant made to contain in ink by colorant this invention, although it is usable in a color system and a paints system, Since addition of a dispersing agent is needed separately and the colorant ratio in total solids becomes low in order to make it distribute uniformly in ink in using paints, colorant of a color system is used preferably. As an addition of colorant, it is preferred the hardening component mentioned later and that it is the following in equivalent amount.
[0077][2]When the process tolerance in a hardening component post process, reliability, etc. are

taken into consideration, it is preferred to contain ingredients, such as the ingredient which hardens by processing of heat treatment or an optical exposure, and fixes colorant, i.e., the monomer for which a bridge can be constructed, and polymer. When the heat resistance in a post process is especially taken into consideration, it is preferred to use the resin composition which can be hardened. For example as base material resin, specifically A hydroxyl group, a carboxyl group, an alkoxy group, Acrylic resin and silicone resin; or hydroxypropylcellulose which has functional groups, such as an amide group, Vinyl system polymer, such as cellulosics, such as hydroxyethyl cellulose, methyl cellulose, and carboxymethyl cellulose, those denaturation thing; or a polyvinyl pyrrolidone, polyvinyl alcohol, and a polyvinyl acetal, is mentioned. It is possible to use the cross linking agent for stiffening these base material resin by an optical exposure or heat-treatment and a photoinitiator. Specifically as a cross linking agent, it is [initiator / dichromate, a screw azide compound, a radical system initiator, a cation system initiator, / anionic system] usable as a photoinitiator in melamine derivatives, such as methylol-ized melamine, again. Two or more sorts of these photoinitiators can be mixed, or it can also be used combining other sensitizers.

[0078][3]As a medium of the ink used by solvent this invention, the mixed solvent of water and an organic solvent is used preferably. It is preferred to use not the common water containing various ion but ion exchange water (deionized water) as water.

[0079]As an organic solvent, methyl alcohol, ethyl alcohol, n-propyl alcohol, Isopropyl alcohol, n-butyl alcohol, sec-butyl alcohol, The alkyl alcohol of the carbon numbers 1-4 of tert-butyl alcohol etc.; Dimethylformamide, Amide, such as dimethylacetamide; Ketone or keto alcohol; tetrahydrofurans, such as acetone and diacetone alcohol, Ether, such as dioxane; Polyalkylene glycol; ethylene glycol, such as a polyethylene glycol and a polypropylene glycol, Propylene glycol, a butylene glycol, triethylene glycol, Thiodiglycol and the alkylene-glycols; glycerin in which it passes and alkylene groups, such as xylene glycol and a diethylene glycol, contain 2-4 carbon; Ethylene glycol monomethyl ether, The low-grade alkyl ether of polyhydric alcohol, such as diethylene-glycol methyl ether and triethylene glycol monomethyl ether; it is preferred to choose from N-methyl-2-pyrrolidone, 2-pyrrolidone, etc.

[0080]In order to consider it as the ink which has a desired property value other than the above-mentioned ingredient if needed, two or more kinds of organic solvents in which the boiling points differ may be mixed and used, or a surface-active agent, a defoaming agent, an antiseptic, etc. may be added.

[0081] Process (f)

The pixel 8 is formed by performing required processings, such as heat treatment and an optical exposure, and removing and stiffening the solvent component in the ink 7.

[0082]In the case of a light filter, as described above, a protective layer and a transparent conducting film are formed if needed. as the protective layer in this case -- a resin material a photo-curing type, a heat-curing type, or light-and-heat concomitant use hardening type -- or, It is usable, if the inorganic film etc. which were formed of vacuum evaporation, weld slag, etc. can be used, it has the transparency at the time of considering it as a light filter and a subsequent transparent conducting film formation process, an orienting film formation process, etc. can be borne. A transparent conducting film may be directly formed on a coloring section, without passing a protective layer. In the case of an EL element, required members, such as a metal layer, are laminated on the pixel 8.

[0083]

[Example](Example 1)

[Formation of a black matrix] On a glass substrate ("1737" by Corning), the black resist (the "V-259BK resist" by Nippon Steel Chemical) containing carbon black is applied, After exposing with insufficient [some], development and postbake processing were performed and 2 micrometers of thickness, 75 micrometers x 225 micrometers, and a section produced the black-matrix pattern (septum) which has an opening of the rectangle of reverse tapered shape.

[0084][Adjustment of ink] Each ink of R, G, and B was prepared by the following presentations, using the acrylic copolymer which consists of a presentation shown below as a heat curing component.
[0085]Hardening component methyl methacrylate 50 weight-section hydroxyethyl methacrylate 30 weight-section N-methylolacrylamide 20 weight sections [0086]R ink C.I. acid orange 148 3.5 weight-section C.I. acid red 289 0.5 weight-section diethylene glycol 30 weight-section ethylene glycol 20 weight-section ion exchange water The 40 weight-section above-mentioned hardening component Six weight sections [0087]The amount part zinc phthalocyanine sulfoamide of G ink C.I. acid yellow 23 duplexs The amount part diethylene glycol of duplexs 30 weight-section ethylene glycol 20 weight-section ion exchange water The 40 weight-section above-mentioned hardening component Six weight sections [0088]B ink C.I. direct blue 1994 weight-section diethylene glycol 30 weight-section ethylene glycol The 20 weight-section ion-exchange-water 40 weight-section above-mentioned hardening component Six weight sections [0089][Parent ink-ized processing] UV washing of the above-mentioned black-matrix board was carried out, and the black-matrix surface and the glass substrate surface were formed into parent ink.
[0090][Fluorination processing] Plasma treatment was performed to the above-mentioned black-matrix board on condition of the following using the parallel plate type plasma treatment apparatus.
[0091]
Gas used : CF_4 gas mass flow : 80sccm pressure : 8PaRF power : 150W processing time : 60 sec
[0092][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the above-mentioned black-matrix board was measured.
[0093]black-matrix upper surface: -- 125-degree glass substrate surface: -- 15 degrees [0094] [Production of a coloring section] Using the ink-jet recording device possessing the ink jet head of discharge quantity 20pl, to the black-matrix board, quantity was changed every 100pl and the above-mentioned R, G, and B ink were given in the range of 200 per opening - 800pl. Subsequently, 230 ** performed heat treatment for 30 minutes succeedingly for 10 minutes at 90 **, ink was stiffened, it was considered as the coloring section (pixel), and seven kinds of light filters in which the amounts of ink grants differ were produced.
[0095][Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.
[0096](Example 2) As parent ink-ized processing of a black-matrix board, it replaced with UV washing and the light filter was produced like Example 1 except oxygen plasma having performed ashing treatment on the conditions shown below.
[0097]
Gas used : O_2 gas mass flow : 80sccm pressure : 8PaRF power : 150W processing time : 30 sec
[0098][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.
[0099]black-matrix upper surface: -- 130-degree glass substrate surface: -- 15 degrees [0100] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.
[0101](Example 3) As parent ink-ized processing of a black-matrix board, it replaced with UV washing and the light filter was produced like Example 1 except having performed alkali cleaning using the sodium hydroxide solution of pH=13.
[0102][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.
[0103]black-matrix upper surface: -- 125-degree glass substrate surface: -- 18 degrees [0104] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.
[0105](Example 4) As parent ink-ized processing of a black-matrix board, it replaced with UV washing, and excimer washing was performed, it replaced with CF_4 as gas used in fluorination

processing, and the light filter was produced like Example 1 except having used C_2F_6.

[0106][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.

[0107]black-matrix upper surface: -- 126-degree glass substrate surface: -- 22 degrees [0108] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.

[0109](Example 5) As parent ink-ized processing of a black-matrix board, it replaced with UV washing, and corona discharge treatment was performed, it replaced with CF_4 as gas used in fluorination processing, and the light filter was produced like Example 1 except having used SF_6.

[0110][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.

[0111]black-matrix upper surface: -- 117-degree glass substrate surface: -- 21 degrees [0112] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.

[0113](Example 6) The light filter was produced like Example 1 except not performing parent ink-ized processing.

[0114][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.

[0115]black-matrix upper surface: -- 120-degree glass substrate surface: -- 50 degrees[0116] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, in the light filter of 300 or less pl, the white omission was observed for the amount of grants of ink. Mixed colors were observed in no light filters.

[0117](Comparative example 1) Appropriate exposure was performed in the black matrix formation process, and except that the section formed the forward tapered shape-shaped black matrix, the light filter was produced like Example 1.

[0118][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.

[0119]black-matrix upper surface: -- 125-degree glass substrate surface: -- 15 degrees [0120] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, the white omission was observed in all the light filters. Mixed colors were observed in no light filters.

[0121](Comparative example 2) The light filter was produced like Example 1 except not having performed fluorination processing.

[0122][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of a black-matrix board was measured.

black-matrix upper surface: -- 70-degree glass substrate surface: -- 15 degrees [0123][Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, the white omission was observed in no light filters. In the color filter substrate of 400 or more pl, mixed colors were observed for the amount of grants of ink.

[0124](Example 7) [Transparent electrode formation] On the TFT driving substrate which a multilayer comes to laminate, per pixel (luminous layer), a wiring film, an insulator layer, etc. which were formed of the thin film process form ITO 40 nm in thickness by sputtering as transparent electrodes, and pattern by the photolitho method according to picture element shape.

[0125][Septum formation] Next, the septum filled up with a luminous layer is formed. A transparent photopolymer ("CT-2000L" by Fuji Photo Film Olin) is applied, After exposing with insufficient [some], development and postbake processing were performed and the section which has 0.4 micrometer of thickness and an opening (75 micrometers x 225 micrometers) on the above-mentioned ITO transparent electrode created the matrix pattern with transparent reverse tapered shape.

[0126][Parent ink-ized processing] The substrate with which the septum was formed like Example 1 was formed into new ink by UV washing.
[0127][Plasma treatment] It carried out on the same conditions as Example 1.
[0128][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of a black-matrix board was measured.
ITO transparent electrode top: -- 17-degree transparent matrix pattern top: -- 101 degrees [0129] [Formation of a luminous layer] Next, it was filled up with the luminous layer in the septum of said substrate. As a luminous layer, it is an electron-transport-property 2,5-bis(5-tert-butyl-2-benzo oxazole yl)-thiophene. [It is electron-transport-property blue light coloring matter with 450 nm of fluorescence peaks, and is one of the luminescence center formation compounds. Hereafter, it is described as "BBOT".] About 30 % of the weight, it is poly-N-vinylcarbazole. [The molecular weight 150,000, the Kanto Kagaku make, and the following describe it as "PVK".] Both were dissolved in the dichloroethane solution so that molecular dispersion could be carried out into the hole transportability host compound which becomes more. The Nile red which is another luminescence center formation compound was dissolved in the dichloroethane solution of PVK-BBOT so that it might become 0.015-mol %, and ink was formed. This ink was filled up with and dried in the septum surrounded by the ink jet method with transparent resin, and the 200-nm-thick luminous layer was formed. At this time, each pixel (luminous layer) became independent and the solution which contains said luminescent material between septa was not mixed by an adjacent pixel. The luminous layer within a septum was distributed uniformly. Furthermore, on this, vacuum deposition of Mg:Ag (10:1) was carried out, and the 200-nm-thick Mg:Ag negative pole was made. Thus, when the voltage of 18V was impressed to each pixel of the made EL element, the uniform white light of 480 cd/m^2 was obtained.
[0130]
[Effect of the Invention]The optical element whose reliability provided with the pixel without mixed colors or a white omission is high according to this invention as explained above can be manufactured with the sufficient yield by a simple process with an inkjet method, The light filter which does not have density unevenness within a coloring section, and the EL element which does not have light-emitting-luminance nonuniformity within a luminous layer can be provided with the sufficient yield. Therefore, the liquid crystal element excellent in color display properties can be more cheaply provided using the above-mentioned light filter.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention]The light filter which is the members forming of the color liquid crystal element by which this invention is used for a color television, a personal computer, a pachinko game stand, etc., And it is related with the liquid crystal element which uses further the light filter which is one of the optical element manufactured by this manufacturing method, and these the optical elements about the manufacturing method which manufactures an optical element called the electroluminescent element provided with two or more luminous layers using an inkjet method.

[Translation done.]

PRIOR ART

[Description of the Prior Art]In recent years, it is in the tendency which the demand of liquid crystal displays, especially color liquid crystal displays increases with development of a personal computer, especially development of a portable personal computer. However, for the further spread, a cost cut is required, and the demand to the cost cut of a light filter with specific gravity heavy in cost is increasing especially.
[0003]Various methods are tried in order to meet the above-mentioned demand from the former, satisfying the demand characteristics of a light filter, but the method of still satisfying all the demand characteristics is not established. Each method is explained below.
[0004]A primary method is a staining technique. After a staining technique forms first the water-soluble polymer material layer which is the material for dyeing on a transparent substrate and patterns this after desired shape according to a photolithography process, it obtains the pattern which immersed the obtained pattern in the dyeing bath and was colored. By repeating this process 3 times, the coloring layer which consists of a coloring section of three colors of R (red), G (green), and B (blue) is formed.
[0005]The second method is a pigment dispersion method and is performed recent years most briskly. This method obtains a monochromatic pattern by forming the photosensitive resin layer which distributed paints and patterning this on a transparent substrate, first. By repeating this process 3 times, the coloring layer which consists of a coloring section of three colors of R, G, and B is formed.
[0006]The third methods include an electrodeposition process. This method patterns a transparent electrode on a transparent substrate first, immerses in the electropainting liquid into which it went, such as paints, resin, and an electrolysis solution, and electrodeposits the first color. This process is repeated 3 times, the coloring layer which consists of a coloring section of three colors of R, G, and B is formed, and it calcinates at the end.
[0007]As the fourth method, paints are distributed to heat-hardened type resin, and after distinguishing R, G, and B by different color with by repeating printing 3 times, a coloring layer is formed by making resin heat-harden. Also in which method, it is common to form a protective layer on a coloring layer.
[0008]The point common to these methods is repeating the same process 3 times, in order to color three colors of R, G, and B, and becoming a high cost. It also has the problem that the yield falls, so that there are many routing counters. In an electrodeposition process, since the pattern shape which can be formed is limited, application is difficult for the composition of the liquid crystal element of the TFT type (TFT, i.e., the active-matrix-driven method using the thin film transistor as a switching element) in the present art.
[0009]Since definition of print processes is bad, they are unsuitable for the pattern formation of a fine pitch.
[0010]The manufacturing method of the light filter using an inkjet method is briskly examined in

recent years in order to compensate the above faults. There is an advantage that the method using an inkjet method has a simple manufacturing process, and it is low cost.
[0011]On the other hand, an inkjet method is applicable not only to manufacture of a light filter but manufacture of an electroluminescent element.
[0012]An electroluminescent element the thin film containing the inorganic matter of fluorescence, and an organic compound, It is an element which has the composition inserted by the negative pole and the anode, makes an exciton generate by making an electron and an electron hole (hole) pour in and recombine with the above-mentioned thin film, and is made to emit light using discharge of the fluorescence at the time of this exciton being deactivated. An inkjet method can give the fluorescence material used for such an electroluminescent element on the substrate which made elements, such as TFT, for example, a luminous layer can be formed, and an element can be constituted.

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EFFECT OF THE INVENTION

[Effect of the Invention]The optical element whose reliability provided with the pixel without mixed colors or a white omission is high according to this invention as explained above can be manufactured with the sufficient yield by a simple process with an inkjet method, The light filter which does not have density unevenness within a coloring section, and the EL element which does not have light-emitting-luminance nonuniformity within a luminous layer can be provided with the sufficient yield. Therefore, the liquid crystal element excellent in color display properties can be more cheaply provided using the above-mentioned light filter.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]As described above, since the inkjet method can plan simplification and the cost reduction of a manufacturing process, it is applied to manufacture of optical elements, such as a light filter and an electroluminescent element. However, in manufacture of such an optical element, there is a problem called "mixed colors" and "white omission" as a problem peculiar to an inkjet method. Hereafter, the case where a light filter is manufactured is mentioned as an example, and is explained.
[0014]"Mixed colors" is obstacles generated when ink is mixed between the pixels (coloring section) of an adjoining different color. It is necessary to the capacity of the opening of a black matrix to give the ink which has one several times - tens times the volume of this by using a black matrix as a septum in the manufacturing method of the light filter which gives ink to the opening of this black matrix and forms a coloring section. In the case where there is comparatively little volume of the ink with high solids concentration contained in ink, such as colorant and a hardening component, case [ink] namely, given, Since a black matrix can fully function as a septum and ink can be held in the opening of this black matrix, the given ink overcomes a black matrix and does not reach even the coloring section of an adjoining different color. However, since ink overflows exceeding the black matrix used as a septum when the solids concentration in ink is low (i.e., when it is necessary to give a lot of ink), mixed colors will occur between adjoining coloring sections. Since it is stabilized from the nozzle of an ink jet head, there is a limit in the viscosity of the ink in which the regurgitation is possible and there is a limit also in the concentration of the solid content contained in ink especially, the art for avoiding mixed colors is required.
[0015]Then, the method of preventing mixed colors using the wettable difference of the ink between a coloring section and a septum is proposed. For example, in JP,59-75205,A, in order to prevent ink from spreading out of an object region, the method of forming a nonproliferation pattern by a bad wettable substance is proposed, but concrete art is not indicated. On the other hand, in JP,4-123005,A, the method of patterning the big silicone rubber layer of water-repellent ** oil repellency operation as a concrete technique, and using as the bridge wall for mixed-colors prevention is proposed. In JP,5-241011,A or JP,5-241012,A, a silicone rubber layer is similarly formed on the black matrix used as a light shielding layer, and the technique used as a septum for mixed-colors prevention is indicated.
[0016]When the ink of the quantity far exceeding the height of a septum is given according to these methods, in order that the surface layer of a septum may show ink repellency, ink can be crawled, even the coloring section which adjoins exceeding a septum cannot be attained to, and mixed colors can be prevented effectively.
[0017]The key map is shown in drawing 3. The black matrix in which 31 served as the transparent substrate among the figure, and 33 served as the septum, and 36 are ink. When the upper surface of the black matrix 33 has ink repellency, as shown in drawing 3 (b), the given ink 36 is held in the opening of the black matrix 33, and does not reach even an adjoining coloring section. However,

when the ink repellency of the upper surface of the black matrix 33 is low, as shown in drawing 3 (a), the given ink 36 will be mixed with the ink given to the opening which gets wet, and spread and adjoins even on the black matrix 33.

[0018]Generally the ink repellency which was [which uses a fluorine compound] more excellent in rather than can be obtained using a silicon compound. For example, in JP,2000-35511,A, the resist pattern of a positive type is formed on a shade part, the method of applying a ** ink-ized processing agent on this pattern further is indicated, and using a fluorine compound is indicated as a ** ink-ized processing agent. However, in the case of this method, it is necessary to remove the positive type resist pattern provided on the shade part after coloring section formation but, and when removing a resist pattern, problems, such as the dissolution of a pixel, exfoliation, and swelling, may be produced.

[0019]The method of plasma-izing the reactant gas of a fluorine compound to JP,6-65408,A, and processing it to it as the technique of fluorinating the surface of a resin layer, is proposed. As an example which applied this art to the light filter, In JP,11-271753,A, it is considered as the multilayer structure of the lower layer which has compatibility for a septum to ink, and the upper layer which has non-compatibility, and the method of carrying out plasma treatment as the technique of making the upper layer non-compatibility to ink by the gas containing a fluorine compound is indicated.

[0020]However, each technique mentioned above multilayers a septum, and since it needs to carry out multiple-times operation of the photolithography process, it has the problem of causing complication of a process, a cost hike, and by extension, yield lowering.

[0021]On the other hand, a "white omission" is an obstacle which the mainly given ink originates in the ability not to be spread enough and uniformly in the field surrounded by the septum, and generates, and causes display failure called the fall of color unevenness or contrast.

[0022]The key map of a white omission is shown in drawing 4. The same numerals were given to the same member as drawing 3 among the figure. 38 is a white omission portion.

[0023]In the light filter for recent-years and TFT type liquid crystal elements, In order to be the purpose of protecting TFT from outdoor daylight, or to enlarge a numerical aperture and to obtain a bright display, The opening configuration of the black matrix 33 is complicated, and since what has two or more corner parts is generally used, as shown in drawing 4 (a), the problem that the ink 36 is not fully spread to this corner part occurs. When forming the black matrix 33, the photolithography process which generally used resist is used, a contaminant may adhere to the surface of the transparent substrate 31 by various ingredients contained in resist, and it may become the hindrance of diffusion of the ink 36. Since the ink 36 will be crawled on the side of the black matrix 33 as shown in drawing 4 (b) when the ink repellency of the side of the black matrix 33 is extremely high compared with the surface of the transparent substrate 31, The problem that a color becomes thin in the portion which the ink 36 and the black matrix 33 touch may occur.

[0024]Using the substrate parent-ink--ization-processed so that the field (crevice) surrounded by the black matrix (heights) might serve as an angle of contact of 20 degrees or less to water in JP,9-203803,A as the technique of solving the problem of such mixed colors or a white omission is proposed. As a method of giving parent ink nature, a water-soluble leveling agent and water-soluble surface-active agent are illustrated. In order to solve simultaneously the problem over the mixed colors mentioned above, the technique of processing the surface of heights by a ** ink-ized processing agent beforehand, and giving ink repellency is indicated, and the method of carrying out a coat with the solvent of a fluorine system is illustrated, using a fluoride content silane coupling agent as a ** ink-ized processing agent. As a technique for forming only the surface layer of heights into ** ink selectively, and not forming the side of heights into ** ink in this case, **. Laminate two kinds of materials so that the heights themselves may produce such character. ** after forming a regist layer on ** transparent substrate which covers portions other than heights by resist, and **-ink--ization-processes only the upper surface of heights and **-ink--ization-processing the whole surface, a regist layer is patterned according to a photolitho step, and heights are formed -- the

method of ** is illustrated.
[0025]In JP,9-230129,A, it is similarly considered as the method of parent-ink--ization-processing a crevice, and the method of irradiating with an energy line is indicated. Also in this case, after applying the photosensitive material for glass substrate convex part formation by making only the surface layer of heights into the method of **-ink--ization-processing and processing the whole surface in a ** ink-ized processing agent, the technique of patterning a photosensitive material according to a photolithography process is illustrated. Then, either is selectively parent-ink--ization-processed simultaneous in heights and a crevice by the exposure of an energy line.
[0026]However, since each of these methods parent-ink--ization-processes a crevice after **-ink--ization-processing the surface of heights, when they performs parent ink-ized processing, they has the problem of reducing the ink repellency of the surface of the **-ink--ization-processed heights. Therefore, it is difficult to obtain sufficient ink repellency for sufficient parent ink nature in the upper surface of a black matrix in a transparent substrate surface and the side of a black matrix, respectively.
[0027]The above-mentioned problem is similarly produced, when manufacturing an electroluminescent element with an inkjet method. Namely, in an electroluminescent element, the organic semiconductor material which emits light in each light of R, G, and B is used as ink, When giving this ink to the field surrounded by the septum, forming a pixel (luminous layer) in it and ink is mixed between adjoining luminous layers, in the luminous layer concerned, the problem that a desired color and luminescence of luminosity are not obtained arises. Since the ink quantity with which it is filled up in a septum is equalized even if it is a luminous layer of a single color, if ink flows into an adjacent pixel, heterogeneity will arise in ink quantity, and it will be recognized as brightness unevenness, and will become a problem. When ink is not fully spread in the field surrounded by the septum, the problem that light emitting luminance sufficient by the boundary part of a luminous layer and a septum is not obtained is produced. In the following description, for convenience, when manufacturing an electroluminescent element, generating of the light-emitting-luminance nonuniformity according mixture **** of the ink between adjoining luminous layers to rebounding of the ink in the boundary part of "mixed colors", a luminous layer, and a septum is described as a "white omission."
[0028]The technical problem of this invention faces optical elements, such as a light filter and an electroluminescent element, using an inkjet method manufacturing cheaply in a simple process, solves the above-mentioned problem, and there is in providing a reliable optical element with the sufficient yield. When specifically giving ink in the field surrounded by the septum, it is in forming the pixel which prevents the mixed colors between the adjoining pixels, and fully diffuses ink in this field, and does not have a white omission. It aims at providing more cheaply the liquid crystal element excellent in color display properties further using the optical element obtained by this manufacturing method in this invention.

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MEANS

[Means for Solving the Problem]It is a manufacturing method of an optical element which has a septum which consists of a resin composition located on a supporting board between two or more pixels and an adjoining pixel at least the first of this invention, A process at which a section of a normal line direction of this board forms a septum of reverse tapered shape on a supporting board, It is a manufacturing method of an optical element having a process of performing fluorination processing to the above-mentioned partition surface, and the process of giving ink to a field surrounded by the above-mentioned septum by an inkjet method, and forming a pixel in it.
[0030]It is the plasma treatment which the above-mentioned fluorination processing introduces gas which contains a fluorine atom at least the first of above-mentioned this invention, and performs plasma irradiation, This shielding agent is [forming the above-mentioned septum with a resin composition containing a shielding agent,] carbon black, In advance of the above-mentioned fluorination processing, parent ink-ized processing is performed to a partition surface and the supporting board surface, This parent ink-ized processing is washing processing by an alkaline aqueous solution, UV washing processing, excimer washing processing, corona discharge treatment, or oxygen plasma treatment, The above-mentioned ink's containing a hardening component, water, and an organic solvent at least and the above-mentioned ink contain colorant, and it includes as a desirable mode that a pixel manufactures a light filter which is a coloring section, and that the above-mentioned pixel manufactures an electroluminescent element which is a luminous layer.
[0031]The second of this invention is an optical element which having a septum located on a supporting board between two or more pixels and an adjoining pixel at least, and manufacturing by a manufacturing method of an optical element of above-mentioned this invention.
[0032]The above-mentioned septum's being a light shielding layer and the above-mentioned supporting board are transparent substrates, the second of above-mentioned this invention is the coloring section formed in ink in which the above-mentioned pixel contains colorant, and it is the light filter provided with a coloring section of a plural color, Having a protective layer on this coloring section, having a transparent conducting film on the surface, or the above-mentioned pixel is a luminous layer, and it includes as a desirable mode that it is an electroluminescent element which has an electrode up and down on both sides of this luminous layer.
[0033]Furthermore, a liquid crystal is pinched between substrates of the third couple of this invention, and it is a liquid crystal element to which one substrate is characterized by being constituted using a light filter which is one mode of an optical element of above-mentioned this invention.
[0034]
[Embodiment of the Invention]The manufacturing method of the optical element of this invention forms the septum formed on a supporting board so that the undersurface where the section of a substrate normal line direction touches the supporting board of reverse tapered shape, i.e., this septum, may become the shape where area is smaller than the upper surface, It has the feature to

perform fluorination processing for increasing the ink repellency of this surface to this partition surface, and for an inkjet method give ink to the field surrounded by this septum, and form a pixel. In this invention, from the section of a septum being reverse tapered shape in the case of fluorination processing. It is thought that the upper surface with a large area serves as a shadow to plasma, the processing grade of the side is low compared with the septum upper surface, and the ink repellency of this side becomes low as a result, and generating of a white omission is suppressed compared with the septum of the conventional forward tapered shape shape or the conventional square, and a rectangle. Since ink repellency with the sufficient septum upper surface is revealed, mixed colors are also prevented simultaneously.

[0035]After carrying out dry hardening of the above "ink" in this invention, the fluid which has functionality optically and electrically, for example is named generically, and it is not limited to the coloring material used conventionally.

[0036]A light filter and an electroluminescent element are mentioned as an optical element of this invention manufactured with the manufacturing method of this invention. First, an embodiment is mentioned and described about the optical element of this invention.

[0037]The section of an example of the light filter which is one embodiment of the optical element of this invention is typically shown in drawing 8. The black matrix in which 81 served as the transparent substrate as a supporting board among the figure, and 82 served as the septum, the coloring section whose 83 is a pixel, and 84 are protective layers formed if needed. In constituting a liquid crystal element using the light filter of this invention, The transparent conducting film which consists of transparent conducting materials, such as ITO (indium tin oxide) for forming the protective layer 84 on the coloring section 83 or the coloring section 83, and driving [**s] a liquid crystal on it, may be formed and provided.

[0038]The cross section of one embodiment of the liquid crystal element of this invention constituted by using the light filter of drawing 8 for drawing 9 is shown. Among a figure, as for a common electrode (transparent conducting film) and 88, a counter substrate and 92 are orienting films a picture element electrode and 93, a liquid crystal and 91 give the same numerals to the same member as drawing 8, and, as for 87, an orienting film and 89 omit explanation.

[0039]A color liquid crystal element generally doubles the substrate 81 and the counter substrate 91 by the side of a light filter, and is formed by enclosing the liquid crystal 89. Inside one substrate 91 of a liquid crystal element, TFT (un-illustrating) and the picture element electrode 92 are formed at matrix form. The coloring section 83 of a light filter is formed inside the substrate 51 by the side of a light filter, and the transparent common electrode 87 is formed on it so that R, G, and B may arrange in the position which counters the picture element electrode 92. The orienting films 88 and 93 are formed in the field of both boards, and the certain direction is made to arrange a liquid crystal element. The placed opposite of these substrates is carried out via a spacer (un-illustrating), they are stuck by the sealant (un-illustrating), and the gap is filled up with the liquid crystal 89.

[0040]In a transmission type, the above-mentioned liquid crystal element forms the substrate 91 and the picture element electrode 92 for a transparent raw material, A polarizing plate is pasted up on the outside of each substrate, and it displays by operating a liquid crystal compound as an optical shutter to which the transmissivity of the light of a back light is changed using the back light which generally combined the fluorescent lamp and the scattered plate. In a reflection type, the substrate 91 or the picture element electrode 92 is formed for the raw material provided with the reflex function, or a reflecting layer is provided on the substrate 91, a polarizing plate is provided in the outside of the transparent substrate 81, and it displays by reflecting the light which entered from the light filter side.

[0041]The cross section of an example of an organic electroluminescence element (it is hereafter described as a "EL element") which are other embodiments of the optical element of this invention is shown in drawing 10. A transparent electrode and 106 are metal layers among a figure the driving substrate which is a supporting board 101, the luminous layer whose 102 is a pixel a septum and

103, and 104. This figure shows only one picture element region for simplification.
[0042]TFT (un-illustrating), a wiring film, an insulator layer, etc. are laminated by the multilayer, and between the transparent electrodes 104 arranged every metal layer 106 and luminous layer 103, per luminous layer, it is constituted by the driving substrate 101 so that impression of voltage is possible. The driving substrate 101 is manufactured by a publicly known thin film process.
[0043]About the structure of the organic EL device of this invention, if at least one side is the composition which it comes at least to fill up a luminescent material in the septum which becomes inter-electrode [which consists of the anode and the negative pole of a transparent or translucent couple] from a resin composition, Unless there is no restriction in particular, and the structure can adopt a publicly known thing and it deviates from the main point of this invention, various kinds of changes can be added.
[0044]The laminated structure is (1) electrode (negative pole) / luminous layer / hole injection layer / electrode (anode), for example.
(2) An electrode (anode) / luminous layer / electronic injection layer / electrode (negative pole)
(3) An electrode (anode) / hole injection layer / luminous layer / electronic injection layer / electrode (negative pole)
(4) An electrode (anode or negative pole) / luminous layer / electrode (negative pole or anode)
****** can apply this invention also to the EL element which has the laminated structure body which provided the organic compound layer of which above-mentioned composition.
[0045]The above (1) is called two-layer structure and a three-tiered structure (4) is called monolayer composition (3). Although the organic EL device of this invention is based on these laminated structures, two or more owners of the structure which combined (1) to (4) other than these, or each layer may be carried out. A full color display may be realized by combining with a light filter. The shape of the organic EL device of this invention which consists of these laminated structures, a size, construction material, a manufacturing method, etc. are suitably chosen according to the use of this organic EL device, etc., and there is no restriction in particular about these.
[0046]The luminescent material in particular used for the luminous layer of the organic EL device of this invention is not limited, but can apply various things. A low molecule fluorescent substance and a polymeric fluorescent substance are preferred, and, specifically, a polymeric fluorescent substance is still more preferred.
[0047]Although there is no limitation in particular as a low molecule organic compound, for example, naphthalene and its derivative, Anthracene and its derivative, perylene and its derivative, a poly methine system, Coloring matter, such as a xanthene series, a coumarin series, and a cyanine system, 8-hydroxyquinoline and the metal complex of the derivative, aromatic amine, a tetraphenylcyclopentadiene and its derivative, tetraphenylbutadiene, its derivative, etc. can be used. Specifically, it is usable in publicly known things, such as what is indicated to JP,57-51781,A and JP,59-194393,A, for example.
[0048]Although there is no limitation in particular as a polymers organic compound usable as a luminescent material, polyphenylene vinylene, polyallylene, polyalkylthio Foehn, a poly alkyl fluorene, etc. can be mentioned.
[0049]The polymeric fluorescent substance used for the organic EL device of this invention may be randomness, a block, or a graft copolymer, and may be the polymers which have those interim structures, for example, the random copolymer which is tinged with block nature. From a viewpoint of obtaining a polymeric fluorescent substance with a high quantum yield of fluorescence, a random copolymer, and the block or graft copolymer which is tinged with block nature is more preferred than a perfect random copolymer. Since the organic EL device of this invention uses luminescence from a thin film, that in which this polymeric fluorescent substance has fluorescence by a solid state is used.
[0050]As a good solvent to this polymeric fluorescent substance, chloroform, a methylene chloride, a dichloroethane, a tetrahydrofuran, toluene, xylene, etc. are illustrated. Although based also on the

structure and the molecular weight of a polymeric fluorescent substance, it can be made to usually dissolve in these solvents 0.1% of the weight or more.
[0051]In the organic EL device of this invention, the electron-transport-property material which uses it into the electron transport layer in the case of providing an electron transport layer further between the layer and the negative pole containing a luminescent material, or carries out mixed use with a hole transporting material and a luminescent material has the function to transmit the electron poured in from the negative pole to a luminescent material. There is no restriction in particular about such an electron-transport-property material, and arbitrary things can be conventionally chosen and used out of a publicly known compound.
[0052]As a desirable example of this electron-transport-property material, a nitration fluorenone derivative, an anthra quinodimethane derivative, a diphenyl quinone derivative, a thiopyrandioxide derivative, a heterocyclic tetracarboxylic anhydride, or a carbodiimide can be mentioned.
[0053]A FUREORENIRIDEN methane derivative, an anthra quinodimethane derivative and the Antron derivative, an oxadiazole derivative, etc. can be mentioned. Although indicated as a material which forms a luminous layer, the metal complex of 8-hydroxyquinoline and its derivative, etc. can be used as an electron transport material.
[0054]Next, the typical manufacturing method of the organic EL device which has a laminated structure which is an example of this invention is described. By the electrode of the couple which consists of the anode and the negative pole, what formed the transparent or translucent electrode, for example on transparent substrates, such as clear glass and a transparent plastic, is used as a transparent or translucent electrode.
[0055]Generally in the EL element of this invention, a luminous layer forms a thin film combining suitable bending resin. Can choose from bending resin wide range as the above-mentioned binder, and For example, polyvinyl-carbazole resin, Polycarbonate resin, polyester resin, polyarylate resin, butyral resin, Although polystyrene resin, polyvinyl-acetal resin, diallyl phthalate resin, an acrylic resin, methacrylic resin, phenol resin, an epoxy resin, silicone resin, polysulfone resin, urea resin, etc. are mentioned, it is not limited to these. as that these are independent or copolymer polymer -- one sort -- or two or more sorts may be mixed and it may use. What has as big a work function as an anode material as possible is good, for example, nickel, gold, platinum, palladium, selenium, a rhenium, iridium, these alloys or tin oxide, tin oxide indium (ITO), and copper iodide are preferred. Conductive polymers, such as poly (3-methylthiophene), a polyphenylene sulfide, or polypyrrole, can also be used.
[0056]On the other hand, silver with a work function small as a cathode material, lead, tin, magnesium, aluminum, calcium, manganese, indium, chromium, or these alloys are used.
[0057]Below, with reference to drawings, the manufacturing method of the optical element of this invention is explained.
[0058]Drawing 1 - drawing 2 are process drawings showing the manufacturing method of the optical element of this invention typically. Each process is explained below. Following process (a) - (f) corresponds to (a) - (f) of drawing 1 - drawing 2. In each process of drawing 1 and drawing 2, - (a-2) (f-2) the mimetic diagram in which - (a-1) on the left-hand side of space (f-1) looked at the substrate in process from the upper part, and on the right-hand side of space is an A-B cross section of - (a-1) (f-1). the inside of a figure, and 1 -- as for the opening of the septum 3, and 6, a resin composition layer and 3 are [ink and 8] pixels an ink jet head and 7 a septum and 4 a supporting board and 2.
[0059] Process (a)
The supporting board 1 is prepared. Although the supporting board 1 is the transparent substrate 81 when manufacturing the light filter illustrated to drawing 8, and a glass substrate is generally used, if it has the required characteristics, such as desired transparency and a mechanical strength, a plastic plate etc. can be used in the purpose of constituting a liquid crystal element.
[0060]When manufacturing the EL element illustrated to drawing 10, the supporting board 1 is the

driving substrate 101 in which the transparent electrode 104 was formed, and in observing luminescence from the substrate side concerned like drawing 10, it uses transparent substrates, such as a glass substrate, for the driving substrate 101. It is preferred to perform surface treatments, such as plasma treatment, UV processing, and coupling processing, to the surface so that the material of the luminous layer 103 may adhere to this substrate easily in a post process.
[0061] Process (b)
The resin composition layer 2 for forming the septum 3 on the supporting board 1 is formed. In the case of the light filter of drawing 8, the septum 3 concerning this invention corresponds at the black matrix 82, and, in the case of the EL element of drawing 10, corresponds at the septum 102. When manufacturing a light filter, as for this especially septum 3, it is preferred to consider it as the light shielding layer which shades between the adjoining pixels, as 82 of drawing 8 showed, and in that case, like drawing 8, it can be made into the black matrix 82, or can also be used as a black stripe. Also when manufacturing an EL element, it is possible to consider it as a light shielding layer.
[0062]As a resin composition used in this invention in order to form the septum 3, Although the resin material of photosensitivity or nonphotosensitivity, such as epoxy system resin, acrylic resin, polyimide system resin containing polyamidoimide, urethane system resin, polyester system resin, and polyvinyl system resin, can be used, It is preferred to have the heat resistance of not less than 250 **, and epoxy system resin, acrylic resin, and polyimide system resin are preferably used from the point.
[0063]In making this septum 3 into a light shielding layer, it uses the black resin constituent which made the shielding agent distribute into the above-mentioned resin composition. It is desirable to use carbon black as this shielding agent, when obtaining high ink repellency on the upper surface of the septum 3 by fluorination processing so that it may mention later, and as this carbon black, What was manufactured by the contacting method currently called channel black, roller black, and disk black, Although what was manufactured by thermal ** currently called what manufactured by the fur nesting method currently called gas fur nest black and oil fur nest black, thermal black, and acetylene black can be used, In particular, channel black, gas fur nest black, and oil fur nest black are preferred. Furthermore, the mixture of the paints of R, G, and B, etc. may be added if needed. The black resist generally marketed can also be used. The light shielding layer high-resistance-ized if needed may be used.
[0064]The resin composition layer 2 can be formed by methods, such as a spin coat, a roll coat, a bar coat, a spray coat, dip coating, or print processes.
[0065] Process (c)
The septum 3 which patterns the resin composition layer 2 and has two or more openings 4 is formed. As shown in drawing 1, the shape of the septum 3 is formed so that an area on top may become large rather than the undersurface where the section of the normal line direction of the supporting board 1 touches the reverse tapered shape 1, i.e., the supporting board of the septum 3. When the photosensitive material of a negative mold is used as the resin composition layer 2, it can be considered as reverse tapered shape by exposing to a properly fewer eye and developing negatives to it.
[0066]It is not limited to the method shown in drawing 1 as a formation method of the septum 3 in this invention, for example, the septum 3 can be formed by a lift off using the photoresist of a positive type. This method is shown in drawing 7. First, the photoresist layer 71 of a positive type is formed on the supporting board 1 (drawing 7 (a)), Pattern after forward tapered shape shape and the photoresist 72 is formed (drawing 7 (b)), The resin composition layer 73 of a positive type is formed in the whole surface (drawing 7 (c)), it can expose from the rear face of the supporting board 1, a development can remove the resin composition on the photoresist 72 and this resist, and the septum 3 of reverse tapered shape can be formed (drawing 7 (d)).
[0067] Process (d)
Fluorination processing is performed to the upper surface of the septum 3. The fluorination

processing concerned is processing for giving ink repellency to the septum 3 upper surface, and preventing the mixed colors at the time of the ink grant in a post process. Therefore, in advance of the processing concerned, it is preferred to perform parent ink-ized processing to the septum 3 surface and the supporting board 1 surface, and the washing processing by an alkaline aqueous solution, UV washing processing, excimer washing processing, corona discharge treatment, and oxygen plasma treatment are mentioned as this parent ink-ized processing.

[0068]As the method of the fluorination processing concerning this invention, a process is easy and the plasma treatment which introduces the gas which contains a fluorine atom at least, and performs plasma irradiation from the ability of-izing of the surface of the septum 3 which consists of resin compositions to be carried out [** ink] effectively is used preferably.

[0069]As gas which is introduced in this process and which contains a fluorine atom at least, It is preferred to use one or more sorts of halogen gas chosen from CF_4, CHF_3, C_2F_6, SF_6, C_3F_8, and C_5F_8. Especially C_5F_8 (octafluoro cyclopentene) has an atmosphere life dramatically as short as 0.98 (CF_4: 50,000 years, C_4F_8:3200 year) compared with conventional gas, while ozone-crack ability is 0. Therefore, a global warming potential is dramatically (CF_4:6500, C_4F_8:8700) small compared with 90 (100-year integrated value set to CO_2=2), and conventional gas, and very effective in an ozone layer or earth environment protection, and it is desirable when using it by this invention.

[0070]As introductory gas, gas, such as oxygen, argon, and helium, may be used together if needed. In this process, the above-mentioned CF_4, CHF_3, C_2F_6. It becomes possible to control the grade of the ink repellency of the septum 3 surface which will be processed in this process in the halogen gas chosen from SF_6, C_3F_8, and C_5F_8 if the mixed gas of one or more sorts and O_2 is used. However, since the oxidation reaction by O_2 will become dominant and an ink repellency improved effect will be barred in the mixed gas concerned, if the mixing ratio of O_2 exceeds 30%, Since the damage to resin will become remarkable if O_2 mixing ratio exceeds 30%, to use the mixed gas concerned, the mixing ratio of O_2 needs to use it in 30% or less of range.

[0071]As a generation method of plasma, methods, such as low frequency wave discharge, high frequency discharge, and microwave discharge, can be used, and conditions, such as a pressure in the case of plasma treatment, a gas mass flow, discharge frequency, and processing time, can be set up arbitrarily.

[0072]The mimetic diagram of the plasma generator which can be used for the plasma treatment process of this invention is shown in drawing 5 and drawing 6. As for an upper electrode and 52, a processed board and 54 are RF electrodes a lower electrode and 53 51 among a figure. The device concerned impresses high frequency voltage to 2 pole electrodes of a parallel plate, and generates plasma. Drawing 5 can show a cathode coupling method, drawing 6 can show the device of an anode coupling method, and ink repellency of the septum 3 surface can be made into a desired grade by conditions, such as a pressure, a gas mass flow, discharge frequency, and processing time, also in which method.

[0073]In the plasma generator shown in drawing 5 and drawing 6, the cathode coupling method of drawing 5 can shorten processing time, and is advantageous to the down stream processing concerned. It is advantageous at the point of not giving a damage to the supporting board 1 in the anode coupling method of drawing 6 more than needed. Therefore, what is necessary is just to choose the plasma generator used for this process according to the material of the supporting board 1 or the septum 3.

[0074]By the process of these series, only the upper surface of the septum 3 has high ink repellency by fluorination processing, and the supporting board 1 surface exposed to the opening 4 and the side of the septum 3 can obtain the matrix pattern substrate which has parent ink nature.

[0075] Process (e)
The ink 7 is given to the field (opening 4) surrounded by the septum 3 from the ink jet head 6 using an ink-jet recording device. As an ink jet, it is usable in the bubble jet (registered trademark) type which used the electric thermal-conversion object as an energy generation element, or the piezo jet type using a piezoelectric element. In the case of what in the case of a light filter contains colorant of each color so that the coloring section of R, G, and B may be formed after hardening, and an EL element, as the ink 7, the material which forms the luminous layer which emits light by voltage impressing after hardening is used. As for the ink 7, in any case, what contains a hardening component, water, and a solvent at least is preferred. It explains still in detail about the presentation of the ink used for it when manufacturing a light filter to below with the manufacturing method of this invention.
[0076][1]As colorant made to contain in ink by colorant this invention, although it is usable in a color system and a paints system, Since addition of a dispersing agent is needed separately and the colorant ratio in total solids becomes low in order to make it distribute uniformly in ink in using paints, colorant of a color system is used preferably. As an addition of colorant, it is preferred the hardening component mentioned later and that it is the following in equivalent amount.
[0077][2]When the process tolerance in a hardening component post process, reliability, etc. are taken into consideration, it is preferred to contain ingredients, such as the ingredient which hardens by processing of heat treatment or an optical exposure, and fixes colorant, i.e., the monomer for which a bridge can be constructed, and polymer. When the heat resistance in a post process is especially taken into consideration, it is preferred to use the resin composition which can be hardened. For example as base material resin, specifically A hydroxyl group, a carboxyl group, an alkoxy group, Acrylic resin and silicone resin; or hydroxypropylcellulose which has functional groups, such as an amide group, Vinyl system polymer, such as cellulosics, such as hydroxyethyl cellulose, methyl cellulose, and carboxymethyl cellulose, those denaturation thing; or a polyvinyl pyrrolidone, polyvinyl alcohol, and a polyvinyl acetal, is mentioned. It is possible to use the cross linking agent for stiffening these base material resin by an optical exposure or heat-treatment and a photoinitiator. Specifically as a cross linking agent, it is [initiator / dichromate, a screw azide compound, a radical system initiator, a cation system initiator, / anionic system] usable as a photoinitiator in melamine derivatives, such as methylol-ized melamine, again. Two or more sorts of these photoinitiators can be mixed, or it can also be used combining other sensitizers.
[0078][3]As a medium of the ink used by solvent this invention, the mixed solvent of water and an organic solvent is used preferably. It is preferred to use not the common water containing various ion but ion exchange water (deionized water) as water.
[0079]As an organic solvent, methyl alcohol, ethyl alcohol, n-propyl alcohol, Isopropyl alcohol, n-butyl alcohol, sec-butyl alcohol, The alkyl alcohol of the carbon numbers 1-4 of tert-butyl alcohol etc.; Dimethylformamide, Amide, such as dimethylacetamide; Ketone or keto alcohol; tetrahydrofurans, such as acetone and diacetone alcohol, Ether, such as dioxane; Polyalkylene glycol; ethylene glycol, such as a polyethylene glycol and a polypropylene glycol, Propylene glycol, a butylene glycol, triethylene glycol, Thiodiglycol and the alkylene-glycols; glycerin in which it passes and alkylene groups, such as xylene glycol and a diethylene glycol, contain 2-4 carbon; Ethylene glycol monomethyl ether, The low-grade alkyl ether of polyhydric alcohol, such as diethylene-glycol methyl ether and triethylene glycol monomethyl ether; it is preferred to choose from N-methyl-2-pyrrolidone, 2-pyrrolidone, etc.
[0080]In order to consider it as the ink which has a desired property value other than the above-mentioned ingredient if needed, two or more kinds of organic solvents in which the boiling points differ may be mixed and used, or a surface-active agent, a defoaming agent, an antiseptic, etc. may be added.
[0081] Process (f)
The pixel 8 is formed by performing required processings, such as heat treatment and an optical

exposure, and removing and stiffening the solvent component in the ink 7.
[0082]In the case of a light filter, as described above, a protective layer and a transparent conducting film are formed if needed. as the protective layer in this case -- a resin material a photo-curing type, a heat-curing type, or light-and-heat concomitant use hardening type -- or, It is usable, if the inorganic film etc. which were formed of vacuum evaporation, weld slag, etc. can be used, it has the transparency at the time of considering it as a light filter and a subsequent transparent conducting film formation process, an orienting film formation process, etc. can be borne. A transparent conducting film may be directly formed on a coloring section, without passing a protective layer. In the case of an EL element, required members, such as a metal layer, are laminated on the pixel 8.

[Translation done.]

* NOTICES *

EXAMPLE

[Example](Example 1)
[Formation of a black matrix] On a glass substrate ("1737" by Corning), the black resist (the "V-259BK resist" by Nippon Steel Chemical) containing carbon black is applied, After exposing with insufficient [some], development and postbake processing were performed and 2 micrometers of thickness, 75 micrometers x 225 micrometers, and a section produced the black-matrix pattern (septum) which has an opening of the rectangle of reverse tapered shape.
[0084][Adjustment of ink] Each ink of R, G, and B was prepared by the following presentations, using the acrylic copolymer which consists of a presentation shown below as a heat curing component.
[0085]Hardening component methyl methacrylate 50 weight-section hydroxyethyl methacrylate 30 weight-section N-methylolacrylamide 20 weight sections [0086]R ink C.I. acid orange 148 3.5 weight-section C.I. acid red 289 0.5 weight-section diethylene glycol 30 weight-section ethylene glycol 20 weight-section ion exchange water The 40 weight-section above-mentioned hardening component Six weight sections [0087]The amount part zinc phthalocyanine sulfoamide of G ink C.I. acid yellow 23 duplexs The amount part diethylene glycol of duplexs 30 weight-section ethylene glycol 20 weight-section ion exchange water The 40 weight-section above-mentioned hardening component Six weight sections [0088]B ink C.I. direct blue 1994 weight-section diethylene glycol 30 weight-section ethylene glycol The 20 weight-section ion-exchange-water 40 weight-section above-mentioned hardening component Six weight sections [0089][Parent ink-ized processing] UV washing of the above-mentioned black-matrix board was carried out, and the black-matrix surface and the glass substrate surface were formed into parent ink.
[0090][Fluorination processing] Plasma treatment was performed to the above-mentioned black-matrix board on condition of the following using the parallel plate type plasma treatment apparatus.
[0091]
Gas used : CF_4 gas mass flow : 80sccm pressure: 8PaRF power : 150W processing time : 60 sec
[0092][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the above-mentioned black-matrix board was measured.
[0093]black-matrix upper surface: -- 125-degree glass substrate surface: -- 15 degrees [0094][Production of a coloring section] Using the ink-jet recording device possessing the ink jet head of discharge quantity 20pl, to the black-matrix board, quantity was changed every 100pl and the above-mentioned R, G, and B ink were given in the range of 200 per opening - 800pl. Subsequently, 230 ** performed heat treatment for 30 minutes succeedingly for 10 minutes at 90 **, ink was stiffened, it was considered as the coloring section (pixel), and seven kinds of light filters in which the amounts of ink grants differ were produced.
[0095][Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.
[0096](Example 2) As parent ink-ized processing of a black-matrix board, it replaced with UV washing and the light filter was produced like Example 1 except oxygen plasma having performed

ashing treatment on the conditions shown below.
[0097]
Gas used : O_2 gas mass flow : 80sccm pressure : 8PaRF power : 150W processing time : 30 sec
[0098][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.
[0099]black-matrix upper surface: -- 130-degree glass substrate surface: -- 15 degrees [0100] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.
[0101](Example 3) As parent ink-ized processing of a black-matrix board, it replaced with UV washing and the light filter was produced like Example 1 except having performed alkali cleaning using the sodium hydroxide solution of pH=13.
[0102][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.
[0103]black-matrix upper surface: -- 125-degree glass substrate surface: -- 18 degrees [0104] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.
[0105](Example 4) As parent ink-ized processing of a black-matrix board, it replaced with UV washing, and excimer washing was performed, it replaced with CF_4 as gas used in fluorination processing, and the light filter was produced like Example 1 except having used C_2F_6.
[0106][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.
[0107]black-matrix upper surface: -- 126-degree glass substrate surface: -- 22 degrees [0108] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.
[0109](Example 5) As parent ink-ized processing of a black-matrix board, it replaced with UV washing, and corona discharge treatment was performed, it replaced with CF_4 as gas used in fluorination processing, and the light filter was produced like Example 1 except having used SF_6.
[0110][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.
[0111]black-matrix upper surface: -- 117-degree glass substrate surface: -- 21 degrees [0112] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, mixed colors and a white omission were observed in no light filters.
[0113](Example 6) The light filter was produced like Example 1 except not performing parent ink-ized processing.
[0114][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.
[0115]black-matrix upper surface: -- 120-degree glass substrate surface: -- 50 degrees[0116] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, in the light filter of 300 or less pl, the white omission was observed for the amount of grants of ink. Mixed colors were observed in no light filters.
[0117](Comparative example 1) Appropriate exposure was performed in the black matrix formation process, and except that the section formed the forward tapered shape-shaped black matrix, the light filter was produced like Example 1.
[0118][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of the black-matrix board after fluorination processing was measured.
[0119]black-matrix upper surface: -- 125-degree glass substrate surface: -- 15 degrees [0120] [Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, the white omission was observed in all the light filters. Mixed colors were

observed in no light filters.
[0121](Comparative example 2) The light filter was produced like Example 1 except not having performed fluorination processing.
[0122][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of a black-matrix board was measured.
black-matrix upper surface: -- 70-degree glass substrate surface: -- 15 degrees [0123][Evaluation of mixed colors and a white omission] When the obtained light filter was observed with the optical microscope, the white omission was observed in no light filters. In the color filter substrate of 400 or more pl, mixed colors were observed for the amount of grants of ink.
[0124](Example 7) [Transparent electrode formation] On the TFT driving substrate which a multilayer comes to laminate, per pixel (luminous layer), a wiring film, an insulator layer, etc. which were formed of the thin film process form ITO 40 nm in thickness by sputtering as transparent electrodes, and pattern by the photolitho method according to picture element shape.
[0125][Septum formation] Next, the septum filled up with a luminous layer is formed. A transparent photopolymer ("CT-2000L" by Fuji Photo Film Olin) is applied, After exposing with insufficient [some], development and postbake processing were performed and the section which has 0.4 micrometer of thickness and an opening (75 micrometers x 225 micrometers) on the above-mentioned ITO transparent electrode created the matrix pattern with transparent reverse tapered shape.
[0126][Parent ink-ized processing] The substrate with which the septum was formed like Example 1 was formed into new ink by UV washing.
[0127][Plasma treatment] It carried out on the same conditions as Example 1.
[0128][Evaluation of ink repellency] It was as follows when the angle of contact over the pure water of a black-matrix board was measured.
ITO transparent electrode top: -- 17-degree transparent matrix pattern top: -- 101 degrees [0129] [Formation of a luminous layer] Next, it was filled up with the luminous layer in the septum of said substrate. As a luminous layer, it is an electron-transport-property 2,5-bis(5-tert-butyl-2-benzo oxazole yl)-thiophene. [It is electron-transport-property blue light coloring matter with 450 nm of fluorescence peaks, and is one of the luminescence center formation compounds. Hereafter, it is described as "BBOT".] About 30 % of the weight, it is poly-N-vinylcarbazole. [The molecular weight 150,000, the Kanto Kagaku make, and the following describe it as "PVK".] Both were dissolved in the dichloroethane solution so that molecular dispersion could be carried out into the hole transportability host compound which becomes more. The Nile red which is another luminescence center formation compound was dissolved in the dichloroethane solution of PVK-BBOT so that it might become 0.015-mol %, and ink was formed. This ink was filled up with and dried in the septum surrounded by the ink jet method with transparent resin, and the 200-nm-thick luminous layer was formed. At this time, each pixel (luminous layer) became independent and the solution which contains said luminescent material between septa was not mixed by an adjacent pixel. The luminous layer within a septum was distributed uniformly. Furthermore, on this, vacuum deposition of Mg:Ag (10:1) was carried out, and the 200-nm-thick Mg:Ag negative pole was made. Thus, when the voltage of 18V was impressed to each pixel of the made EL element, the uniform white light of 480 cd/m^2 was obtained.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is process drawing of one embodiment of the manufacturing method of the optical element of this invention.
[Drawing 2]It is process drawing of one embodiment of the manufacturing method of the optical element of this invention.
[Drawing 3]It is a key map of mixed colors by which it is generated in the manufacturing method of the optical element by an inkjet method.
[Drawing 4]It is a key map of a white omission by which it is generated in the manufacturing method of the optical element by an inkjet method.
[Drawing 5]It is a mimetic diagram showing an example of the composition of the plasma generator which can be used in the manufacturing method of this invention.
[Drawing 6]It is a mimetic diagram showing other composition of the plasma generator which can be used in the manufacturing method of this invention.
[Drawing 7]It is a cross section showing other formation processes of the septum concerning this invention.
[Drawing 8]It is a cross section of an example of the light filter which is one embodiment of the optical element of this invention.
[Drawing 9]It is a cross section of one embodiment of the liquid crystal element of this invention.
[Drawing 10]It is a cross section of an example of the electroluminescent element which are other embodiments of the optical element of this invention.
[Description of Notations]
1 Supporting board
2 Resin composition layer
3 Septum
4 Opening
6 Ink jet head
7 Ink
8 Pixel
31 Transparent substrate
33 Black matrix
36 Ink
38 White omission
51 Upper electrode
52 Lower electrode
53 Processed board
54 RF electrode
71 Photoresist layer

72 Photoresist
73 Resin composition layer
81 Transparent substrate
82 Black matrix
83 Coloring section
84 Protective layer
87 Common electrode
88 Orienting film
89 Liquid crystal
91 Counter substrate
92 Picture element electrode
93 Orienting film
101 Driving substrate
102 Septum
103 Luminous layer
104 Transparent electrode
106 Metal layer

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A manufacturing method of an optical element which has a septum which consists of a resin composition located on a supporting board between two or more pixels and an adjoining pixel at least characterized by comprising the following.
A process at which a section of a normal line direction of this board forms a septum of reverse tapered shape on a supporting board.
A process of performing fluorination processing to the above-mentioned partition surface, and a process of giving ink to a field surrounded by the above-mentioned septum by an inkjet method, and forming a pixel in it.

[Claim 2]A manufacturing method of the optical element according to claim 1 which is the plasma treatment which the above-mentioned fluorination processing introduces gas which contains a fluorine atom at least, and performs plasma irradiation.
[Claim 3]A manufacturing method of the optical element according to claim 1 or 2 which forms the above-mentioned septum with a resin composition containing a shielding agent.
[Claim 4]A manufacturing method of the optical element according to claim 3 whose above-mentioned shielding agent is carbon black.
[Claim 5]A manufacturing method of the optical element according to any one of claims 1 to 4 which performs parent ink-ized processing to a partition surface and the supporting board surface in advance of the above-mentioned fluorination processing.
[Claim 6]A manufacturing method of the optical element according to claim 5 which is washing processing according [the above-mentioned parent ink-ized processing] to an alkaline aqueous solution, UV washing processing, excimer washing processing, corona discharge treatment, or oxygen plasma treatment.
[Claim 7]A manufacturing method of the optical element according to any one of claims 1 to 6 with which the above-mentioned ink contains a hardening component, water, and an organic solvent at least.
[Claim 8]A manufacturing method of the optical element according to any one of claims 1 to 7 with which the above-mentioned ink contains colorant and a pixel manufactures a light filter which is a coloring section.
[Claim 9]A manufacturing method of the optical element according to any one of claims 1 to 7 with which the above-mentioned pixel manufactures an electroluminescent element which is a luminous layer.
[Claim 10]An optical element which having a septum located on a supporting board between two or more pixels and an adjoining pixel at least, and manufacturing by a manufacturing method of the optical element according to any one of claims 1 to 7.
[Claim 11]The optical element according to claim 10 whose above-mentioned septum is a light

shielding layer.
[Claim 12]The optical element according to claim 10 or 11 which the above-mentioned supporting board is a transparent substrate, and the above-mentioned pixel is the coloring section formed in ink containing colorant, and is the light filter provided with a coloring section of a plural color.
[Claim 13]The optical element according to claim 12 which has a protective layer on the above-mentioned coloring section.
[Claim 14]The optical element according to claim 12 or 13 which has a transparent conducting film on the surface.
[Claim 15]The optical element according to claim 10 or 11 which the above-mentioned pixel is a luminous layer and is an electroluminescent element which has an electrode up and down on both sides of this luminous layer.
[Claim 16]A liquid crystal element, wherein it pinched a liquid crystal between substrates of a couple and one substrate is constituted using the optical element according to any one of claims 12 to 14.

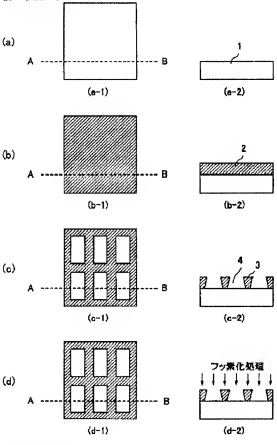
[Translation done.]

* NOTICES *

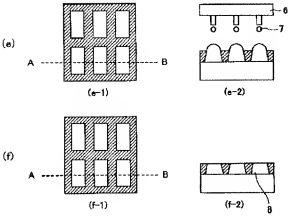
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

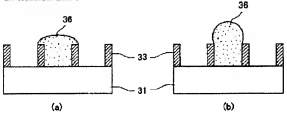
[Drawing 1]



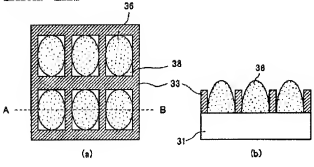
[Drawing 2]



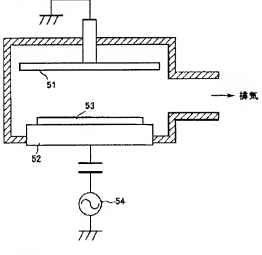
[Drawing 3]



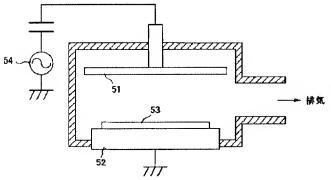
[Drawing 4]



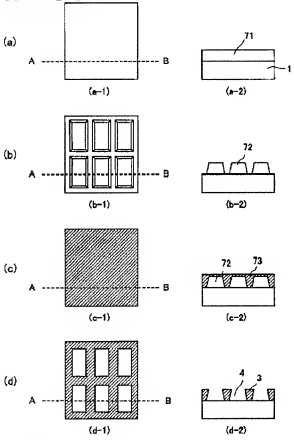
[Drawing 5]



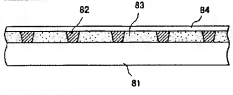
[Drawing 6]



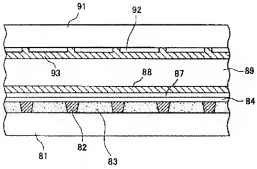
[Drawing 7]



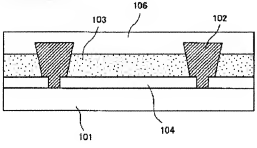
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]